GR 47/GR 48
Technical Description

Sony Ericsson

CE

The product described in this manual conforms to the Radio Equipment and Telecommunication Terminal Equipment (R&TTE) directive 99/5/EC with requirements covering EMC directive 89/336/EEC and Low Voltage directive 73/23/EEC. The product fulfils the requirements according to 3GPP TS 51.010-1, EN 301489-7 and EN60950.

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1 Introduction

1.1 Overview

The GR47/GR48 belong to a new generation of Sony Ericsson Mobile Communications GSM modules. This document describes the main characteristics and functionality of the GR47/GR48, two dual band products for 900/1800 MHz and 850/1900 MHz GSM bands respectively.

They are intended to be used in both machine-to-machine applications and man-to-machine applications. The module serves its purpose when there is a need for sending and receiving data (by SMS, CSD, HSCSD, or GPRS), as well as making voice calls over the GSM network.

GR47/GR48 are business-to-business products. It is intended to be sold to manufacturers, system integrators, applications developers- developing solutions with wireless communication. The module is intended to be integrated by the system integrator within an application. The module and the external application will form a system for wireless communication.

A typical system is one where a micro controller in an external application communicates with the module over its serial interface. The micro controller will control the module, via the supported set of AT commands. It is assumed that the system integrators have a high technical knowledge and the ability to integrate the module into a system. For the GR47/GR48 modules some interesting applications are the following:

- Fleet and Asset Management
- Vending Machines
- Security and Alarm
- Other telemetry applications

1.2 Features

The module performs a set of telecom services (TS) according to GSM standard phase 2+, ETSI and ITU-T. The functions of the module are implemented by issuing AT commands over the serial interface. Supported AT commands are listed in section 5, these are defined

further in GSM 7.05/7.07 and the GR47/GR48 integrator's manual.

1.2.1 Type of Mobile Station

The GR4X family are normal dual band type of MS with the following characteristics.

GR47	*GSM 900*	*E-GSM 900*	*GSM 1800*
Frequency Range (MHz)	TX: 880-915	TX: 880-890	TX: 1710-1785
	RX: 935-960	RX: 925-935	RX: 1805-1880
Channel spacing	200 kHz		200 kHz
Number of channels	173 Carriers *8 (TDMA)		374 Carriers *8 (TDMA)
	GSM: Channels 1 to 124		DCS: Channels 512 to 885
	E-GSM: Channels 975 to 1023		
Modulation	GMSK		GMSK
TX Phase Accuracy	< 5º RMS Phase error (burst)		< 5º RMS Phase error (burst)
Duplex spacing	45 MHz		95 MHz
Receiver sensitivity at antenna connector	< - 102 dBm		< - 102 dBm
Transmitter output power at antenna connector	Class 4		Class 1
	2W (33 dBm)		1W (30 dBm)
Automatic hand-over between GSM 900 and GSM 1800			

GR48	*GSM 850*	*GSM 1900*
Frequency Range (MHz)	TX: 824-849	TX: 1850-1910
	RX: 869-894	RX: 1930-1990
Channel spacing	200 kHz	200 kHz
Number of channels	123 carriers *8 (TDMA)	298 Carriers *8 (TDMA)
	GSM: Channels 128 to 251	PCS: Channels 512 to 810
Modulation	GMSK	GMSK
TX Phase Accuracy	< 5º RMS Phase error (burst)	< 5º RMS Phase error (burst)
Duplex spacing	45 MHz	80 MHz
Receiver sensitivity at antenna connector	< - 102 dBm	< - 102 dBm
Transmitter output power at antenna connector	Class 4	Class 1
	2 W (33 dBm)	1W (30 dBm)
Automatic hand-over between GSM 850 and GSM 1900		

1.2.2 SMS

The module supports the following SMS services:

- Sending: MO, both PDU and Text mode supported.
- Receiving: MT, both PDU and Text mode supported.
- Cell broadcast is a service, in which a message is sent to all subscribers located in one or more specific cell(s) in the GSM network, for example, cell location information.
- SMS status reports according to GSM 03.40.

The maximum length of an SMS message is 160 characters when using 7-bit encoding. For 8-bit data, the maximum length is 140 characters.

The module supports upto 6 concatenated messages to extend this function.

1.2.3 Voice calls

The GR47/GR48 offers the capability of MO and MT voice calls, as well as supporting emergency calls. In addition to this multiparty, call waiting and call deflection features are available. Some of these features are operator specific.

The module offers normal analogue input/output lines, analogue audio input/ output lines in differential modes, and digital audio interface, with the possibility of accessing internal points within the digital audio lines. Moreover, the GR47/GR48 has an embedded echo canceller and noise suppression, which provide high quality audio and can handle limited car kit/speaker phone applications.

The module supports HR, FR and EFR voice coding, provided that EFR is available in the network. The R5 software now also supports AMR for the US market.

1.2.4 Data

The module supports the following data protocols for interfacing to the mobile network:

- *General Packet Radio Service (GPRS).* The modules are Class B Terminals, which provides simultaneous activation and attach of GPRS and GSM services. The GR47/GR48 modules are GPRS 4+1 devices, which are capable of transmitting in one timeslot per frame (uplink), and receiving in a maximum of four timeslots per frame (downlink).
- *Circuit Switched Data (CSD).* GR47/GR48 modules are capable of establishing a circuit switch data link at 9.6 kbps.

- *High Speed Circuit Switched Data (HSCSD).* GR47/GR48 supports HSCSD communication, with one timeslot per frame capacity in the uplink and two timeslots per frame capacity in the downlink (2+1).

1.2.5 SIM Card

The module supports the connection of an external SIM Card with 3V or 5 V technology, via the 60-pin system connector. The module does not have an internal SIM holder.

1.2.6 Power consumption

	Stand-by	*Transmit/Operation*
GSM 850 & 900 MHz	<5 mA	275 mA (2A peak)
GSM 1800 & 1900 MHz	<5 mA	250 mA (1.75A peak)

Note! The power consumption during transmission is measured at maximum transmit power.

1.2.7 Other features

- 07.10 Multiplexing
- GPS interoperability
- SIM application toolkit, class 2 release 96 compliant
- Embedded applications (see section 6)
- On board TCP/IP stack using both AT commands and embedded applications (see section 7).

1.2.8 Development Kit

Sony Ericsson Mobile Communications provides the opportunity to test the module in a limited scale, before ordering a large quantity.

1.2.8.1 M2mpower Package

With the M2mpower package you can quickly get started with the module. The developer's Kit as part of the M2mpower Package includes necessary accessories (software and hardware) that you will need for your test purposes. It also includes the following:

- GSM module GR47 or GR48
- Integrator's Manual

- M2mpower IDE
- M2mpower application guide

The Integrator's Manual provides you with all the information you need to be able to integrate the module with your application. The Embedded Applications software IDE is supplied ready to run on a suitable PC and comes with extensive help files, training course and support.

1.2.8.2 Developer's kit

As an alternative, the Integrator's Manual and Universal Development Board are available as a separate offering. The kit includes other necessary accessories (software and hardware) that you will need for your test purposes.

These are available from your regional salesperson or M2M customer support (see section 9).

1.3 Precautions

The GR47/GR48 should be handled like any mobile station. In the Integrators' Manual you will find more information about safety and product care. In the Technical Data chapter in this document the environmental and electrical limits are specified. Never exceed these limits to ensure the module is not damaged.

1.4 Abbreviations

Abbreviation	*Explanation*
AMR	Adaptive Multi Rate vocoder
ATMS	Audio To Mobile Staition
AFMS	Audio From Mobile Station
CBS	Cell Broadcast Service
CBM	Cell Broadcast Messaging
CSD	Circuit Switch Data
DCE	Data Circuit Terminating Equipment
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
EA	Embedded Application (s)
EFR	Enhanced Full Rate codec

EMC	Electro-Magnetic Compatibility
ETSI	European Telecommunications Standards Institute
FR	Full Rate codec
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Comunication
HR	Half Rate codec
HSCSD	High Speed Circuit Switched Data
IDE	Integrated Developers Environment
IP	Internet Protocol
ITU-T	International Telecommunication Union – Telecommunications Standardisation Sector
ME	Mobile Equipment
MMCX	Micro Minature Coax
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
PCM	Pulse Code Modulation
PDU	Protocol Data Unit
RLP	Radio Link Protocol
RF	Radio Frequency
RFU	Reserved for Future Use
RTC	Real Time Clock
SDP	Service Discovery Protocol
SMS	Short Message Service
SIM	Subscriber Identity Module
TCP	Transport Control Protocol
TBD	To Be Defined
UDP	User Datagram Protocol

2 Mechanical Description

2.1 Interface Description

The picture below presents the conceptual mechanical design of the GR47/GR48. The GR47/GR48 are protected with AISI 304 Stainless Steel covers suitable to fulfill the environmental and EMC requirements. Dimensions, the position of the different connectors and mounting holes are shown in figure 2.2.

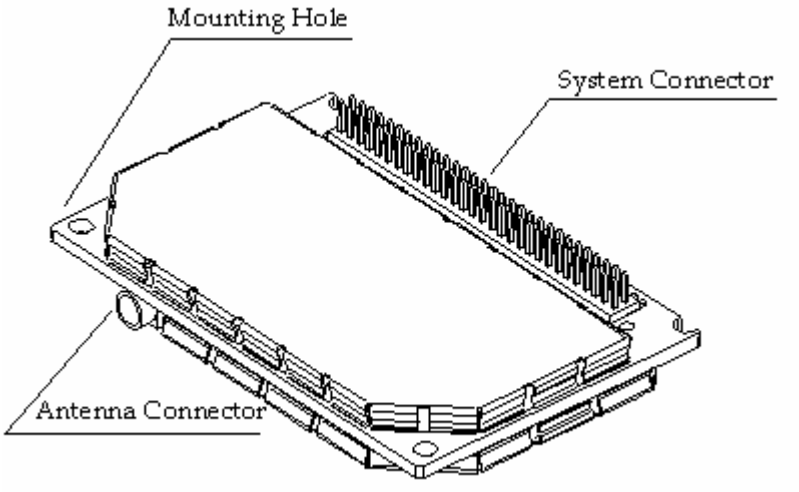

Figure 2.1 GR 47/48, view from the underside

2.2 Physical Dimensions

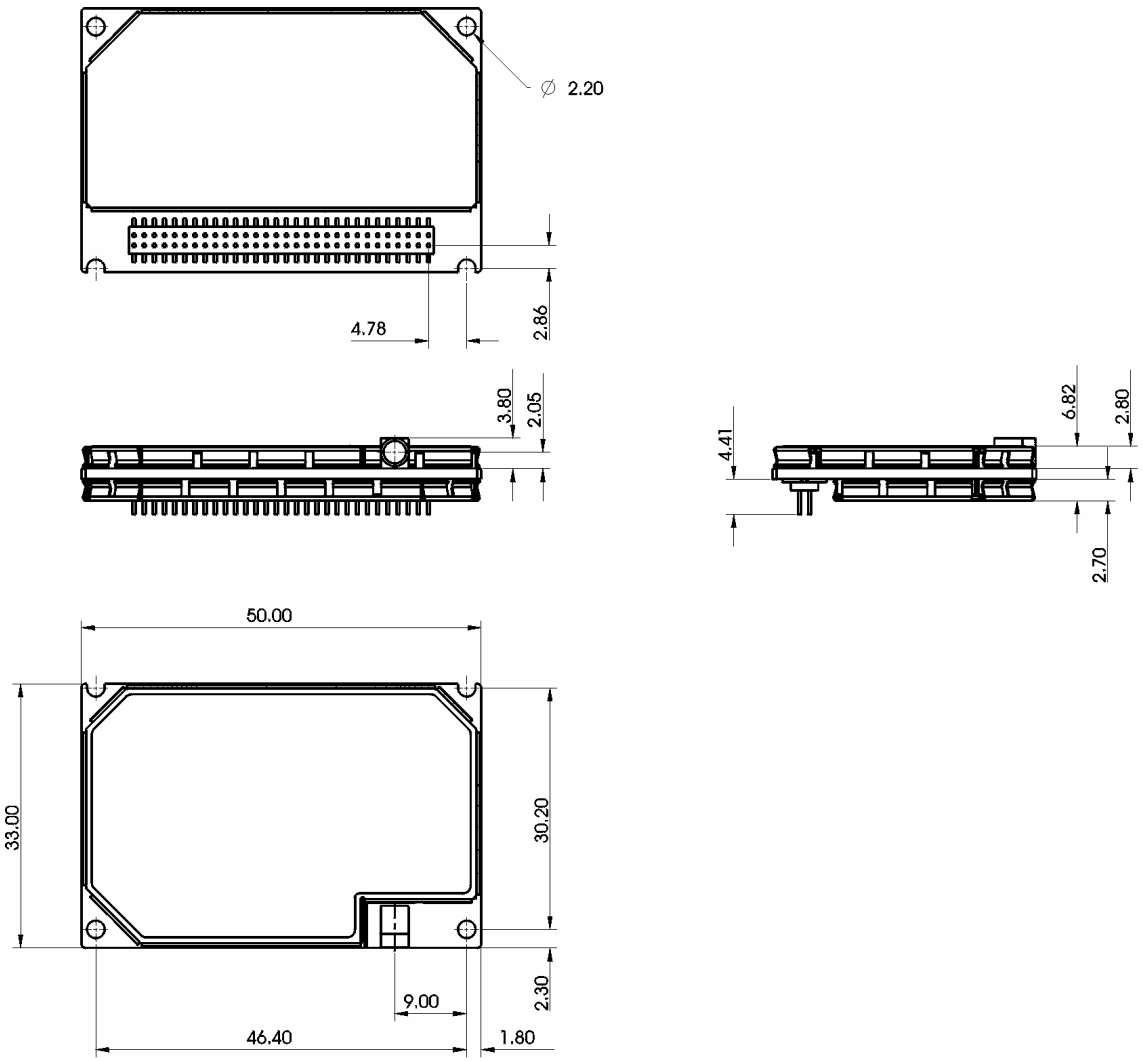

Figure 2.2 Physical dimensions of GR 47/48

The measures are given in millimetres. See also chapter 6, Technical Data.

3 System Connector Interface

3.1 Overview

The electrical connections to the module (except the antenna), are made through the System Connector Interface.

The connector shall allow the following connections: board to board and board to cable. Details of connector availability and sources are available from customer support on request.

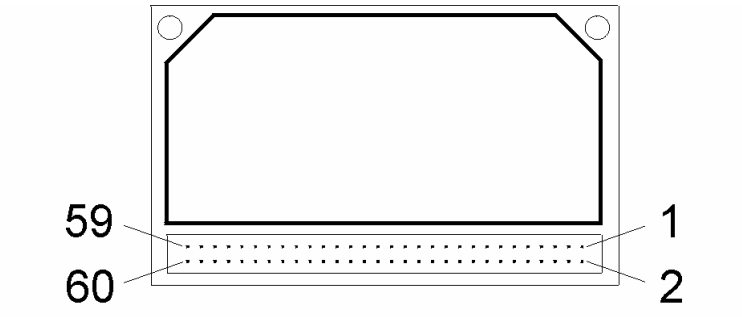

Figure 3.1 GR 47/48. View from the underside

The table on next page provides the pin assignment of the different signals in the System Connector Interface as well as a short description of them.

All signal directions are with respect to the module i.e. Direction 'O' means data being sent by the module.

Pin	*Signal Name*	*Dir*	*Signal Type*	*Description*
1.	VCC	-	Supply	Power Supply
2.	DGND	-	-	Digital Ground
3.	VCC	-	Supply	Power Supply
4.	DGND	-	-	Digital Ground
5.	VCC	-	Supply	Power Supply
6.	DGND	-	-	Digital Ground
7.	VCC	-	Supply	Power Supply
8.	DGND	-	-	Digital Ground
9.	VCC	-	Supply	Power Supply
10.	DGND	-	-	Digital Ground
11.	CHG_IN	-	Batt Charge (power)	Battery charging
12.	DGND	-	-	Digital Ground
13.	IO5	I/O	Dig 2.75	General Purpose input/output 5
	ADC4	I	Analogue	Analogue to digital converter 4
14.	ON/OFF	I	Internal pull up, open drain	Turns the module on/off Former WAKE_B
15.	SIMVCC	-	Dig. 3/5 V	SIM card power supply Power output for SIM Card from module
16.	SIMPRESENCE	I	Internal pull up, open drain	SIM Presence A "1" shall indicate that the SIM is missing; a "0" that it is inserted.
17.	SIMRST	O	Dig. 3/5 V	SIM card reset
18.	SIMDATA	I/O	Dig. 3/5 V	SIM card data
19.	SIMCLK	O	Dig. 3/5 V	SIM card clock
20.	DAC	O	Analogue	Digital to Analogue converter
21.	IO1	I/O	Digital, 2.75	General purpose input/output 1
	KEYROW2	I		Keyboard row 2
22.	IO2	I/O	Digital, 2.75	General purpose input/output 2
	ADC 5	I	Analogue	Analogue to digital converter 5
23.	IO3	I/O	Digital, 2.75	General purpose input/output 3
	KEYROW3	I		Keyboard row 3
24.	IO4	I/O	Digital, 2.75	General purpose input/output 4
	KEYROW4	I		Keyboard row 4
25.	VRTC	I	Supply 1.8 V	Voltage for real time clock
26.	ADC1	I	Analogue	Analogue to digital converter 1
27.	ADC2	I	Analogue	Analogue to digital converter 2
28.	ADC3	I	Analogue	Analogue to digital converter 3
29.	SDA	I/O	2.75, internal pullup	I^2C Data
30.	SCL	O	2.75, internal pullup	I^2C Clock
31.	BUZZER	O	Dig. 2.75	Buzzer output from module

32.	O3	O	Dig. 2.75	General purpose output 5
	KEYCOL3	O		Keyboard column 3
	DSR	O		Data Set Ready
33.	LED	O	Dig. 2.75	Flashing LED
	IO6	I/O		General purpose I/O 6
34.	VIO	O	Power Out 2.75	Module powered indication. The VIO is a 2.75 V output that could power external devices to transmit data towards the GSM device to a 75mA max.
35.	TX_ON	O	Dig 2.75	This output shall indicate when the GSM module is going to transmit the burst.
36.	RI	O	Dig. 2.75	Ring Indicator
	KEYCOL2	O		Keyboard column 2
	O2	O		General purpose output 2
37.	DTR	I	Dig. 2.75	Data Terminal Ready
	KEYROW1	I		Keyboard row 1
	IN1	I		General purpose input 1
38.	DCD	O	Dig. 2.75	Data Carrier Detect
	KEYCOL1	O		Keyboard column 1
	O1	O		General purpose output 1
39.	RTS	I	Dig. 2.75	Request To Send
	IO9	I/O		General purpose I/O 9
40.	CTS	O	Dig. 2.75	Clear To Send
	KEYCOL4	O		Keyboard column 4
	O4	O		General purpose output 4
41.	TD	I	Dig. 2.75	Transmitted Data [former DTMS]
42.	RD	O	Dig. 2.75	Received Data [former DFMS]
43.	TD3	I	Dig. 2.75	UART3 Transmission
	I/O7	I/O		General purpose I/O 7
44.	RD3	O	Dig. 2.75	UART3 Reception
	I/O8	I/O		General purpose I/O 8
45.	TD2	I	Dig. 2.75	UART2 Reception [Former CTMS]
46.	RD2	O	Dig. 2.75	UART2 Transmission [Former CFMS]
47.	PCMULD	I	Dig. 2.75	DSP PCM digital audio input
48.	PCMDLD	O	Dig. 2.75	DSP PCM digital audio output
49.	PCMO	O	Dig. 2.75	Codec PCM digital audio output
50.	PCMI	I	Dig. 2.75	Codec PCM digital audio input
51.	PCMSYNC	O	Dig. 2.75	DSP PCM frame sync
52.	PCMCLK	O	Dig. 2.75	DSP PCM clock output
53.	MICP	I	Analogue	Microphone input positive
54.	MICN	I	Analogue	Microphone input negative
55.	BEARP	O	Analogue	Speaker output positive
56.	BEARN	O	Analogue	Speaker output negative

57.	AFMS	O	Analogue	Audio output from module
58.	SERVICE	I	12V/2.7V	Flash programming voltage for the MS. Enable logger information if no flashing Former VPPFLASH
59.	ATMS	I	Analogue	Audio input to module
60.	AGND	-	Analogue	Analogue ground

Note! Although the pin out has changed the unit remains backwardly compatible with the GM47.

3.2 General Electrical and Logical Characteristics

Many of the signals present in the interface are high-speed CMOS logic inputs or outputs powered from 2.75 V ± 5 %. Whenever a signal is defined as Dig. 2.75 V, the following electrical characteristics shall apply.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*	*Output Current I_o*
High Level Output Voltage (V_{OH})	2.2		2.75	Volts	- 2 mA
Low Level Output Voltage (V_{OL})	0		0.6	Volts	2 mA
High Level Input Voltage (V_{IH})	1.93		2.75	Volts	
Low Level Input voltage (V_{IL})	0		0.5	Volts	

3.2.1 General Protection Requirements

All 2.75V digital inputs shall continuously withstand any voltage from -0.5V up to 3.47V (3.3V + 5%) in the power-on or power-off condition with no damage. All 2.75V digital outputs shall continuously withstand a short circuit to any voltage within the range from 0V to 3V.

Note! This is for protection ONLY, the module cannot be driven directly by a 3.3V micro processor, if this is done it will invalidate any warranty claim on the module.

Please see the Design Guidelines document for information on how to interface directly to a 3.3V microprocessor.

The SIM output signals and the SIMVCC supply can continuously withstand a short circuit to any voltage within the range from 0V to 4.1V.

3.3 Grounds

Pins	Name	Description
2, 4, 6, 8, 10, 12	DGND	Digital Ground
60	AGND	Analogue Ground

There are two ground signals in GR 47/48, Analogue Ground (AGND) and Digital Ground (DGND). The analogue Ground is connected to pin number 60, and the Digital Ground is connected to the System Connector Interface through pin numbers 2, 4, 6, 8, 10 and 12.

Note! All the Ground pins have to be connected to the application. The AGND is connected to the DGND in the ME, and *only* there. It is important that the AGND and the DGND are separated in the application.

3.3.1 The Analogue Ground

The AGND lead is the analogue audio reference ground. It is the return signal for Audio To Mobile Station (ATMS) and Audio From Mobile Station (AFMS).

It shall be connected to the Digital Ground (DGND) inside the module and only there. The application shall not connect DGND and AGND.

Parameter	Limit
I_{max}	≅12.5mA

3.3.2 The Digital Ground (DGND)

DGND is the reference for all digital signals in the System Interface. It shall also be the DC return for the power supply on VCC and SERVICE. Each DGND pin is rated at 0.5 A. All DGND pins are connected internally in the module.

All DGND pins should be connected commonly in the application.

Parameter	Limit
$I_{average}$	< 0.5 A No DGND pin can withstand over 0.5 A
I_{max}	< 600 mA (100 mA each)

3.4 Regulated Power Supply

Pins	*Name*	*Description*
1, 3, 5, 7, 9	VCC	Regulated Power Supply

The regulated power supply, VCC, is connected to the pin numbers 1, 3, 5, 7 and 9.

3.4.1 Power Supply (VCC)

The VCC supplies the module with external power. Any other voltage needed is generated internally.

Parameter	*Mode*	*Limit*
Voltage to be applied	Nominal	3.6 Volts
	Tolerance including ripple [1]	3.4 Volts - 4.0 Volts
	Over voltages	5.5 Volts
Current Drive capability at TX Full Power		< 600 mA (average))
		< 2 A (Peak)

The GR47/48 does not have the internal capacitance to supply the large current peaks during GSM transmission, therefore, on burst transmission the application DC source is responsible for providing the appropriate current.

Design application notes are available from customer support on request.

3.4.2 Battery Charging Input (CHG_IN)

The battery charging pin is design to provide a charging current into a battery. The precise algorithm is TBD but it will be one of the following

- Generic charging algorithm implemented and further refinements for the algorithm to be implemented through embedded applications (see section 6).
- Specific charging algorithms for SEM approved batteries.

1 Measured at system connector pins.

Note! This has not been implemented into any versions of module software and is for future use.

3.5 ON/OFF and External Power Signals

Pins	*Name*	*Dir*	*Description*
14	ON/OFF	I	Square signal to turn on/off the module
34	VIO	O	External power supply

3.5.1 Module ON/OFF

The module is powered ON/OFF by grounding (pulling low) pin 14 as per figure 3.2 below. The pin should then be released as it has an internal pull up to return it to the high state.

Note! Driving with 2.75V or 3.6V is not permitted and restricts module functionality.

Parameter	*Minimum*	*Typical*	*Maximum*	*Units*
Voltage HIGH Level (FALSE)			VCC	By internal pull up only
Voltage LOW Level (TRUE)	0		0.3*VCC	Volts
Pull-up Resistance	Internal pull up		39	KΩ

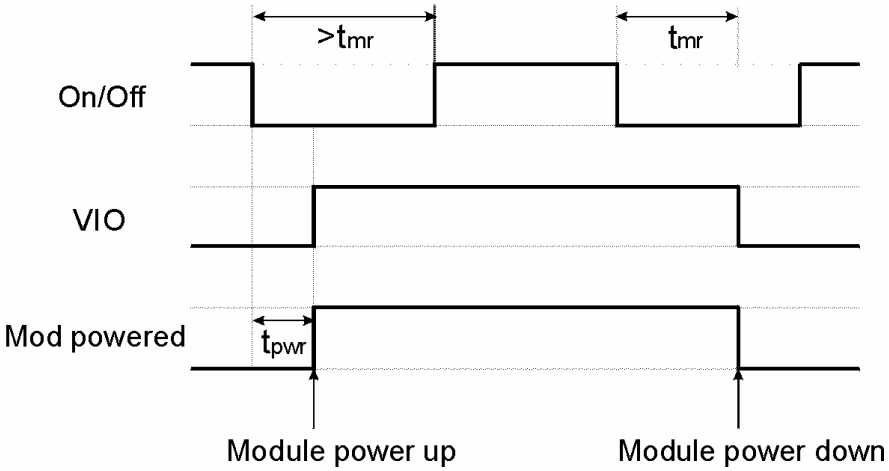

Figure 3.2ON/OFF and VIO performance

Where the times are defined as follows:

Time	*Description*	*Min*	*Typ*	*Max*	*Unit*
t_{mr}	Time to start an ON/OFF operation	1	1.5		S
t_{pwr}	Time for module start-up once ON/ OFF signal has set to TRUE	100		200	mS

3.5.2 External 2.75 V (VIO)

The VIO has been derived from a 2.75 V regulator. It is possible to use this output as a power supply at 2.75 V with a maximum of 75mA.

It will indicate that the module is alive and it could power external devices. In this case, the external applications do not need to implement a 2.75 volt regulator to adapt the incoming (from module point of view) serial data.

Parameter	*Minimum*	*Typical*	*Maximum*	*Units*
Output Voltage (I_{load}=50 mA)	2.70	2.75	2.85	Volts
Load current			75	mA

3.6 Analogue Audio

Pins	*Name*	*Dir*	*Description*
57	AFMS	O	Audio From Mobile Station
59	ATMS	I	Audio To Mobile Station
60	AGND	-	Reference for analogue audio

ATMS and AFMS are the audio input and output for the module. The analogue audio signals can be used in two different modes, Handsfree and Portable Handsfree.

Handsfree

This mode is referred to as Audio To Mobile Station (ATMS) and Audio From Mobile Station (AFMS). It is used by audio accessories such as Handsets and Handsfree equipment.

Portable Handsfree

This mode activates a different amplification factor in the Mobile Equipment (ME). It also activates a microphone bias level in ATMS. This is the default mode.

3.6.1 Audio To Mobile Station (ATMS)

ATMS is the analogue audio input to the module. It connects to the audio input of the CODEC in the module. The CODEC then converts the analogue audio to digital audio, in PCM format, which is connected to the internal PCM bus in the module. The internal PCM bus connects the encoded audio to PCMO on the system connector.

ATMS is also used as the microphone input from the Portable Handsfree. If this is the case, a DC bias is provided from the ATMS.

All sources must be AC-coupled except the Portable Handsfree microphone, which shall be DC-coupled in order to supply DC current to the Portable Handsfree microphone. AC coupling prevents incorrect biasing or damage of the ATMS input. The capacitor must have a value greater than shown below to avoid attenuation of low frequencies.

The ATMS input is a passive network followed by the transmit part of the CODEC.

Parameter		*Limit*
Application driving impedance (0.3 - 3.5 kHz)		< 300 Ω
AC coupling capacitance [2]		> 1 μF
Module input impedance (0.3 - 3.5 kHz)		>50KΩ
Low frequency cut-off (- 3 dB)		300 Hz ± 50 Hz
High frequency cut-off (- 3 dB)		> 3500 Hz
Maximum allowed input level		$1.5V_{pp}$ = 530mV
Output DC bias level	Handsfree mode	2 V
	Portable Handsfree mode	2 V ± 0.1 V
Additional Gain in Portable Handsfree mode		28.5 dB

Maximum input level at ATMS 245mV_{rms} output at PCMO = 3dBm0.

The following table is with nominal PGA (Programmable Gain Settings).

For more information see AT commands in the integrators manual.

Input	Input Volts mV_{rms}	TXAGC dB	AUXI1 Gain	PCMO dBm0
ATMS	245	0	13	3

Maximum input level at MICI 61.4mV_{rms} output at PCMO = 3dBm0

Input	Input Volts mV_{rms}	TXAGC dB	AUXI1 Gain	PCMO dBm0
MICI	61.4	0	25	3

Output at AUX02 for 3dBm0 at PCMI

Input	dBm0	RXPGA	Volume Control dB	AUX02 mV_{rms}
PCMI	3dBm0	0	0	436

2 AC coupling capacitance must be supplied by the application, unless a DC coupled microphone is used.

Output at BEAR for 3dBm0 at PCMI

Input	dBm0	RXPGA	Volume Control dB	BEAR mV_{rms}
PCMI	3dBm0	0	0	388

3.6.2 Audio From Mobile Station (AFMS)

AFMS is the analogue audio output from the module. When it is active, the output is derived from the PCM digital audio by the decoder part of the CODEC. The PCM data comes from PCMI on the system connector. It is also used as an ear-piece driver for the Portable Hands Free accessory.

Parameter		*Limit*
Speaker impedance		64 Ω το 1KΩ
AFMS Output Capacitance		2.2 μF ±10%
Levels (THD < 5 %)	Drive capability into 5 kΩ (0.3 - 3.5 kHz)	> 2.4 Vpp [TBC]
	Drive capability into 1.5 kΩ (0.3 - 3.5 kHz)	> 2.2 Vpp [TBC]
	Drive capability into 150 Ω (at 1kHz)	> 1.3 Vpp [TBC]

3.7 Microphone Signals

Pin	*Speaker signals*	*Dir*	*Function*
53	MICP	I	Microphone Positive Input
54	MICN	I	Microphone Negative Input

MICP and MICN are the microphone-input pins. These inputs shall be compatible with an electret microphone. The microphone contains a FET buffer with open drain output, which must be supplied with at least +2V relative to ground.

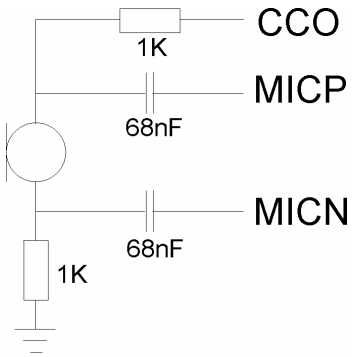

Figure 3.3 Microphone connection to module

CCO is the internal source voltage that will provide the necessary drive current for the microphone (This is not provided by the module).

Parameter	*Limit*
CCO	2.0 - 2.5 V

3.8 Speaker Signals

Pin	*Speaker signals*	*Dir*	*Function*
55	BEARP	O	Microphone Positive Output
56	BEARN	O	Microphone Negative Output

BEARP and BEARN are the speakers output pins. These outputs are in differential mode.

3.9 Digital Audio

Pin	*PCM signal*	*Dir*	*Function*
52	PCMCLK	O	PCM clock
51	PCMSYNC	O	PCM frame sync
47	PCMULD	I	PCM audio input to DSP
48	PCMDLD	O	PCM audio output to DSP
50	PCMI	I	PCM audio input to Codec
49	PCMO	O	PCM audio output to Codec

The digital PCM audio signals allow the connection of a digital audio source / receiver, bypassing the analogue audio CODEC processing functions performed within the module.

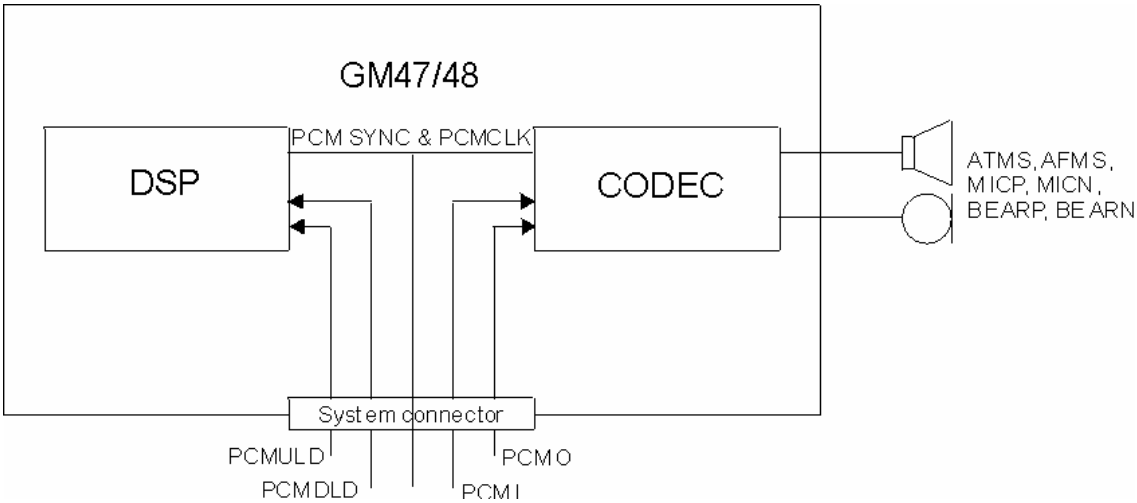

Figure 3.4 Pin connections to digital audio

In the case where no external audio processing is performed, then it is necessary to connect the following signals at the system connector:

- PCMDLD (pin 47) and PCMI (pin 50)
- PCMULD (pin 48) and PCMO (pin 49)

Electrical characteristics

The Dig. 2.75 V CMOS Output/Input electrical characteristics shall apply, with DGND as the reference.

PCM interface format

The PCM format (for PCMULD and PCMDLD) shall follow a linear PCM data I/O format of an industry standard Texas Instrument DSP. It is the same format as the one used between the CODEC and the DSP. The DSP is the source of the bit clock PCMCLK and the frame synchronisation PCMSYNC. The data bits in PCMULD and PCMDLD shall be aligned so that the MSB in each word occurs on the same clock edge.

3.10 Serial Data

Pin	*Name*	*Dir*	*Description*	*RS232 CCITT Nº*
41	TD	I	Serial data to module	103
42	RD	O	Serial data from module	104
39	RTS	I	Request To Send	105
	IO9	I/O	General purpose I/O 9	
40	CTS	O	Clear To Send	106
	KeyCOL4	O	Key column 4	
	O4	O	General purpose output 4	
37	DTR	I	Data Terminal Ready	108.2
	KeyROW1	I	Keyboard column 1	
	I/O1		General purpose I/O 1	
38	DCD	O	Data Carrier Detect	109
	KeyCOL1	O	Key column 1	
	O4	O	General purpose output 1	
36	RI	O	Ring Indicator	125
	KeyCOL2	O	Key column 2	
	O2	O	General output 2	
45	TD2	I	UART 2 Data Transmission	
46	RD2	O	UART 2 Data Reception	
43	TD3	I	UART 3 Data Reception	
44	RD3	O	UART 3 Data Transmission	

The serial channels are used as asynchronous communication links between an application system or accessory units connected to the Module. They consist of three UART's.

UART 1 – This has full RS232 and is used for all on and off line communication.

- UART 2 – May be used for interfacing to a GPS unit, downloading software, receiving logging information, etc.
- UART 3 – May be used by embedded applications.

The Dig. 2.75 V CMOS Output / Input electrical characteristics shall apply, with DGND as the reference. Extra relevant data is specified for some of the signals.

The character format supported is, 1 start bit, 8 bit data, non-parity plus 1 stop bit, in total 10 bits per character.

Note! As stated in section 3.2.1 the module is unable to directly interface to a 3.3V micro processor.

Note! As can be seen from the pin out table, several of the RS232 pins have multiple functionality, this is user selectable with the RS232 functionality set as default.

3.10.1 UART 1 (RS232) - RD, TD, RTS, CTS, DTR, DCD, DSR and RI

The UART1 signals form a 9 pin RS-232 (V.24) serial port.

The signal levels do not match the standard RS-232 (V.28) levels. The relationship between the levels is shown in the table below

RS - 232 Level	*RD, TD*	*RTS, CTS, DTR, DCD, RI*	*2.75 V CMOS Level*
< - 3 V	1	OFF	> 1.93
> + 3 V	0	ON	< 0.80 V

Conversion between the 2.75V CMOS levels and the RS232 levels can be achieved using a standard interface IC, such as the Maxim Integrated Products MAX3237.

3.10.2 Serial Data Signals - RD, TD

The default baud rate is 9.6 kbit/s, however higher bit rates up to 460 kbit/s are supported and are set by the AT+IPR command. The UART 1 starts at a rate of 9.6 kbit/s in standard AT mode or binary mode (First received data AT or binary will determine the operation mode).

The GSM 07.10 multiplexing protocol is supported and is started on command, in this case bit rates up to 460 kbit/s are supported.

Serial Data From Module (RD)

RD is an output used to send data on the UART 1 to the application system. This is a Dig. 2.75 CMOS Output and general characteristics are applicable.

Parameter	*Limit*
Application load resistance	< 100 kΩ
Application load capacitance	< 500 pF

Serial Data To Module (TD)

TD is input (to the module) used by the application system to send data on the UART 1 to the module. This is a Dig. 2.75 CMOS Input and general characteristics are applicable.

Parameter	*Limit*
Application driving impedance	<100 Ω
Input capacitance	1 nF
Input resistance (pull-down)	100 kΩ to 2.75 V

3.10.3 Control Signals - RTS, CTS, DTR, DCD, RI, DSR

The control signals are active low, and hence when a standard interface IC is used (such as MAX3237), then standard RS-232 levels are obtained.

These signals together with DGND, RD and TD form a 9-pin RS-232 data port (with the exception of the voltage levels).

RTS and CTS shall be capable of transmitting at 1/10 of the data transmission speed for data rates, up to 460 kbit/s. (Byte oriented flow control mechanism).

Switching times for RTS and CTS

Parameter	*Limit*
Time from Low to High level	< 2 μs
Time from High to Low level	< 2 μs

Request to Send (RTS)

RTS is an input to the module. The signals on this circuit are used to condition the DCE (the module when used for data transmission purposes) for data transmission. Default level is OFF, by internal pull up.

The exact behaviour of RTS is defined by the AT+IFC command. Software or hardware flow control can be selected. Hardware flow control is the default.

This is a Dig. 2.75 CMOS Input and general characteristics are applicable.

It is the duty of the application to pull RTS low (logic levels) to request communications with the module. The module will respond by asserting CTS low and as such may be used as a notification as a module status ready for communication.

Parameter	*Limit*
Application driving impedance	< 100 Ω
Input capacitance	< 2 nF
Input resistance (pull-down)	100 kΩ to DGND

Clear To Send (CTS)

CTS is an output from the module. The signals on this circuit are used to indicate that the DCE (the module when used for data transmission purposes) is ready to transmit data. Default level is high.

The exact behaviour of CTS is defined by the AT+IFC command. Software or hardware flow control can be selected.

This is a Dig. 2.75 CMOS Output and general characteristics are applicable.

Note! If only software flow control is to be used it becomes necessary to assert RTS low or to connect RTS to CTS at the module.

Parameter	*Limit*
Application load capacitance	< 500 pF
Application load resistance	> 1 MΩ

Data Terminal Ready (DTR)

DTR is an input to the module. Signals from the DTE on this circuit indicate the DTE is ready to transmit and receive data. DTR also acts as a hardware 'hang-up' so that calls are terminated if DTR is OFF (high).

Default level is ON (low). The exact behavior of DTR is defined by the AT&D command.

This is a Dig. 2.75 CMOS Input and general characteristics are applicable.

Data Carrier Detect (DCD)

DCD is an output from the module. An ON (low) signal shall indicate that a valid carrier (data signal) is being received by the DCE (module). The exact behavior of DCD is defined by the AT&C command.

This is a Dig. 2.75 CMOS Output and general characteristics are applicable.

Ring Indicator (RI)

RI is an output from the module. An ON (low) signal indicates a ringing signal is being received by the DCE (module).

This is a Dig. 2.75 CMOS Output and general characteristics are applicable.

DSR (Data Set Ready)

The DSR signal must be switched on using the at&s command. If DSR is enabled it will indicate an active state (low) if the module is in command mode and inactive (high) if the module is in on line data mode.

3.10.4 UART 2 - TD2, RD2

The UART 2 consists of a full duplex serial communication. This involves the transmission and reception lines.

The communication port shall work in one mode: Operation and Maintenance mode.

Operation and Maintenance mode shall work in addition with the SERVICE signal. On switching the module on, if the SERVICE signal is active then two events can happen. If no data is sent to the module, then the logger is activated. Otherwise, the module shall be ready to be reprogrammed.

Timing and Electrical signal characteristics equal to UART 1 TD and RD, except for maximum baud rate that could be increased to 921 kbps.

Transmitted Data 2 (TD2)

TD2 is input (to the module) used by the application system to send data on the UART 2 to the module.

The electrical characteristics shall be the same as TD.

Received Data 2 (RD2)

RD2 is an output used to send data on the UART 2 to the application system.

The electrical characteristics shall be the same as RD.

3.10.5 UART 3 - TD3, RD3

The UART 3 consists of a full duplex serial communication. This involves the transmission and reception lines.

Timing and electrical signals characteristics equal to UART 1 TD and RD.

Transmitted Data 3 (TD3)

TD3 is input (to the module) used by the application system to send data on the UART 3 to the module.

The electrical characteristics shall be the same as TD.

Received Data 3 (RD3)

RD is an output used to send data on the UART 3 to the application system.

The electrical characteristics shall be the same as RD.

3.11 SIM Card related signals

Parameter	*Mode*	*Signal*	*Min.*	*Typ.*	*Max.*	*Unit*
SIM supply Voltage	3 V	SIMVCC	2.7	3.0	3.3	V
	5 V		4.5	5.0	5.5	V
High Level Input Voltage (V_{IH})	3 V	SIMDAT	2.1		3.0	V
	5 V		3.5		5.0	V
Low Level Input Voltage (V_{IL})	3 V	SIMDAT	0		0.9	V
	5 V		0		1.5	V
High Level Output Voltage (V_{OH})	3 V	SIMDAT	2.7		3.0	V
	5 V		4.7		5.0	V
Low Level Output Voltage (V_{OL})	3 V	SIMDAT	0		0.2	V
	5 V		0		0.2	V
High Level Output Voltage (V_{OH})	3 V	SIMCLK SIMRST	2.4		3.0	V
	5 V		4.4		5.0	V
Low Level Output Voltage (V_{OL})	3 V	SIMCLK SIMRST	0		0.35	V
	5 V		0		0.3	V

3.11.1 SIM Detection – SIM Presence

SIMPRESENCE is an input intended to be used to determine whether a SIM card has been inserted or removed in the external SIM card holder. It shall be normally wired to the "Card Inserted Switch" of the external SIM card holder.

When left open an internal pull up resistor maintains the signal high and means ‘SIM card missing’ to the module. When pulled low the module assumes a SIM card is inserted.

SIMPRESENCE is a digital CMOS 2.75 input with the following characteristics.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Pull-up resistance (at 2.75 V)	100			kΩ
Low Level Input Voltage (SIM inserted)			0.8	V
High Level Input Voltage (SIM missing)	1.93		5	V

Note! The module has been Type Approved with SIM presence implemented, to avoid extra testing when type approving the application this should be designed in.

3.12 Service/Programming

Pin	*Signal*	*Description*
58	SERVICE	Flash programming voltage

This input shall be used as a programming voltage for the Flash Memory to initiate and it is also used as a signal to indicate to the module that it should start outputting logging information.

Mode	*SERVICE Voltage (V)*			*Drive Capacity*
	Min.	*Typ.*	*Max.*	
Normal Operation			0.8	-
Service/enable programming	1.9	2.75	3.6	> 1 mA
Absolute maximum voltage			13.5	-

3.13 Buzzer

Pin	*Signal*	*Description*
31	Buzzer	Buzzer output from the module

This is an output signal which allows the application to use pre- programmed melodies or sounds. Typical use would involve a transistor buffer with a piezoelectric sounder.

The Dig. 2.75 V CMOS Output electrical characteristics shall apply, with DGND as the reference.

3.14 LED

Pin	*Signal*	*Description*
33	LED	LED Output from module
	I/O6	General purpose I/O 6

This is an output signal which allows the use of an external LED. The LED shall indicate different states within the module.

This signal is a Dig. 2.75 V CMOS output so general characteristics are applicable. In order to connect a LED in the external application the following scheme shall be followed.

The operation of the LED is hardcoded and is not controlled by the host application.

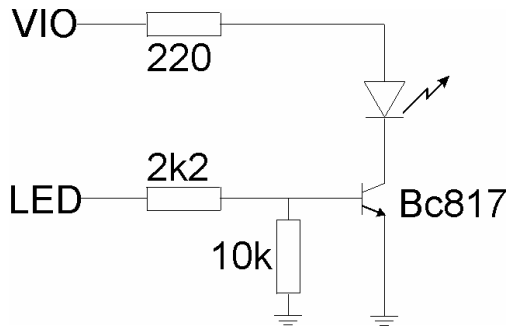

Figure 3.5 Electrical connection for LED

3.15 TX_ON - Burst Transmission

Pin	*Signal*	*Dir*	*Description*
35	TX_ON	O	GSM module on transmission

The TX_ON is a digital signal output. This shall indicate that the module is going to transmit the burst. Burst transmission is the time when a GSM transceiver unit is transmitting in its timeslot assigned by the network.

Dig 2.75 CMOS Output so general electrical characteristics are applicable.

3.16 Real Time Clock

The Real Time Clock provides the module with a time-of-day calendar with alarm and one hundred-year calendar to the main microprocessor.

The real time clock operates with a separate power supply. Therefore, two modes of operation shall be distinguished:

- RTC Normal operation: This is when the MS is powered/Vcc present and it does not take into account if the MS is in OFF or ON.
- RTC Backup operation: This operation is performed when the MS is not powered, VCC = 0V. In this case the RTC operation is maintained by the backup power supply.
- The backup power supply is a passive power supply, capacitor, golden- capacitor, battery etc, which shall be connected outside the MS to VRTC pin. During the RTC normal operation, the passive power supply is being charged; this is like charging a capacitor.

In backup operation, the backup source provides with enough voltage for RTC operations. The following table shows both voltage operations characteristics.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Supply Voltage RTC (Normal Operation – Charging the capacitance)	1.6	1.8	2.0	V
Supply Voltage RTC (Backup Operation – Capacitance provides with voltage)	1.0	1.8	2.0	V

Current drawn	5.0	10.0	μA

In Back-up operation if the voltage drop below 1 Volt, the RTC shall stop working. The following diagram shows the RTC connection:

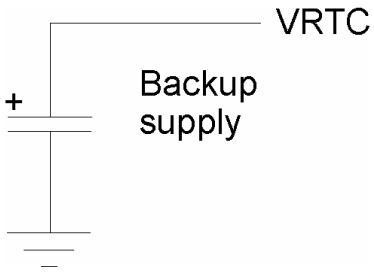

Figure 3.6 RTC connection

Note! There is no requirement to have this fitted to use the RTC.

3.17 Extended IO capabilities

In order to increase the flexibility and variety of GR47 peripherals, the RS232 hardware flow control shares its physical interface with the keypad scanning interface and extended general purpose IO capability. Due to the nature of this sharing, it is not feasible to operate all these features concurrently (although, with care, dynamic switching from one feature to another and back is possible).

When a particular feature is required of an IO, the software automatically sets the states of the relevant IO blocks disabling one set and enabling others. This is most noticeable with the RS232 hardware flow control when switching on the keypad functionality (in embedded applications only).

If full hardware flow control and handshaking is required there will be no available keypad column drivers and the keypad interfacing will be disabled. If intermediate hardware flow control is selected (RTS and CTS only), the unused flow control pins (DTR, DCD, RI, DSR) are made available to the keypad interface providing three discrete matrix column drivers.

If RS232 hardware flow control is switched off altogether, the remaining keypad column driver is enabled allowing the full keypad matrix of 5 columns by 4 rows.

3.17.1 LED/IO6

The LED function pin can be used as a general purpose digital IO when the flashing LED function is not required. However, this pin does not have an on-board pull-up resistor. It is required that an external pull-up or pull-down resistor be provided by the host circuitry when either not used or when used as a digital input.

3.17.2 I#/O#

When not being used for an alternative function the pins labelled I# and O# may be used for general purpose inputs or outputs respectively. The inputs have an on-board 100k pull-up resistor and the outputs are driven rail-to-rail at 2.75V levels.

3.17.3 UART3/IO#

The UART3 pins have been given alternative functions as general purpose I/O, both pins may be used for either input or output. However, the TX pin has a 100kΩ pull-down resistor to ground and the RX pin has a 100kΩ pull-up resistor to 2.75V. This must be taken into consideration when designing the host circuit.

3.17.4 IO#/ADC#

To increase analogue input capabilities, the GR47 optimises the IO by multiplexing or sharing different features on single pins. There are two digital IO pins which now have an additional ADC input. When configured as digital IO, the software will not read the voltages at the two new ADC inputs. When configured as ADC inputs the software will configure the digital IO pins as input or high impedance tri-state. In this state any applied voltage between 0V and 2.75V can be read as an 8 bit value.

Because the additional ADC inputs (ADC4 and ADC5) are common with digital IO, the input circuit of the ADC is not the same as for the original circuits ADC1-3. It is important to understand the input structure of the pin so that the correct analogue voltage is read by the application. The input structure is provided in figure 3.7. It consists of a 100kΩ pull-up to 2.75V followed by a series 1kΩ and 10nF capacitor to ground which make a low pass filter with a

3dB roll-off at about 16kHz. The input impedance of the analogue IC is 1MΩ minimum.

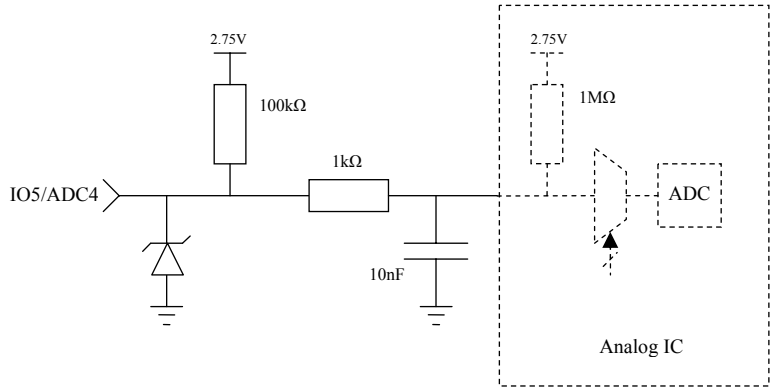

Figure 3.7 Input circuit for combined digital IO and ADC pins

3.18 Keyboard interface (embedded applications only)

To increase IO capabilities, the GR47 optimises the IO by multiplexing or sharing different features on single pins. The IO has been extended to allow simple interfacing of a matrix keypad.

3.18.1 IO#/KEYROW#

When configured for keypad operation the software will configure the digital IO pins as input or high impedance tri-state. In this state the keypad matrix row can be read from the KEYROW# inputs. These pins have a 100kΩ pull-up to 2.75V and the rows are considered activated when the voltage is pulled low by the external keypad switches.

3.18.2 KEYCOL#

The keypad matrix column drivers share functionality with the RS232 hardware flow control signals. When configured for keypad operation the software will configure the hardware flow control to either intermediate or off.

With intermediate flow control the number of keypad column outputs is limited to three, with flow control switched off, the number of keypad column outputs is increased to four. In addition to the keypad column outputs it is possible to use a direct ground connection as an additional column driver, which is interpreted as column zero.

Thus it is possible to create a variety of keypad matrix sizes from single column to five columns wide.

Finally, a standard keypad matrix directly connects the rows to the columns whenever a key is depressed. In order to avoid short circuits if multiple keys are pressed simultaneously, the column drivers must be open-collector. This must be achieved with external transistors as the logic drive from the GR47 is rail-to-rail. Suitable transistors for this interface are of the type with built in bias resistors between base and emitter.

The method of connection is shown in 3.8 below.

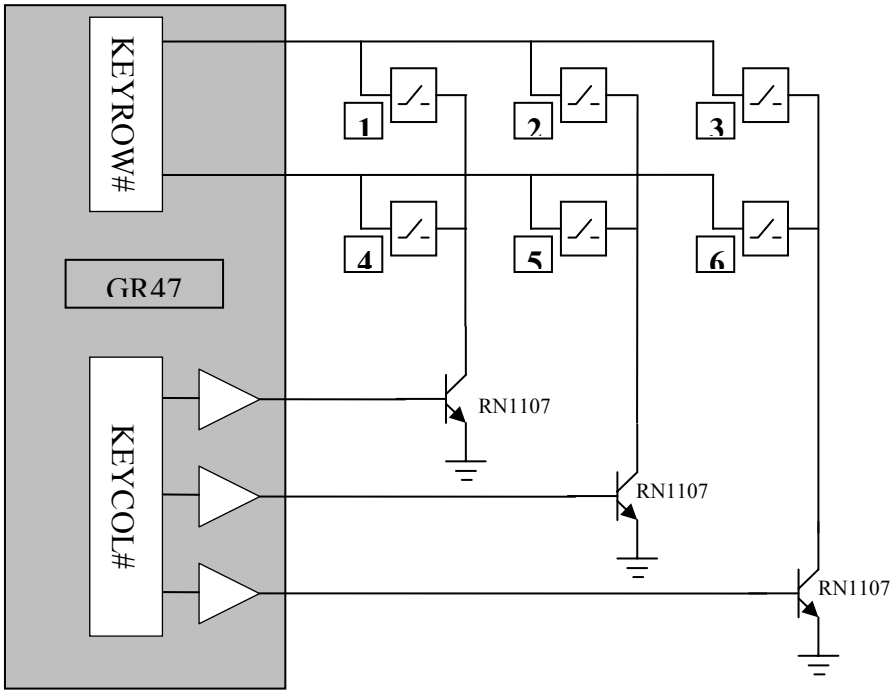

Figure 3.8 Keyboard matrix connections

4 Antenna Connector

The Antenna Connector is a hub for transmission of the Radio Frequency (RF) signals from the module to the external customer- supplied antenna. It is a MMCX connector that is mounted on the surface of the module. Most dealers should be able to supply this type of connector.

This table provides the electrical characteristics at the antenna interface.

Parameter	*Limit*	*Description*
Nominal impedance	$50\ \Omega$ (SWR < 2:1)	
Output Power	2 Watt peak (Class 4)	Extended GSM 900
	1 Watt peak (Class 1)	GSM 1800
Static Sensitivity	Better than - 102 dBm	Extended GSM 900
	Better than - 102 dBm	GSM 1800

5 AT Command Summary

The AT standard is a line-oriented command language. "AT" is an abbreviation of ATtention and it is always used to start sending a command line from a TE to the TA.

The command line consists of a string of alphanumeric characters. It is sent to the modem to instruct it to perform the commands specified by the characters.

Functionality	*AT commands*
CONTROL AND IDENTIFICATION	
Subscriber Information	AT+CNUM, AT+CIMI, AT*ESNU
Product & Release info	AT+CGMR, AT+CGSN, AT*ESIR
Generic information & Settings	AT, AT*, AT+CLAC, AT+GCAP, ATI, AT+CSCS, AT&F, AT&W, ATZ, AT+WS46, AT*E2SSN
CALL CONTROL	
General call control	ATA, ATD, ATL, ATH, ATP, ATT, AT+CHUP, AT+CMOD, AT+CVHU, AT+CR, AT+CRC,
DTMF	AT+VTS
Data commands	ATO, AT+CRLP
AUDIO CONTROL	
Audio profile modification	AT*E2EAMS
Audio profile manipulation	AT*EALR, AT*EAMS, AT*EARS, AT*ELAM, AT*EMIR, AT*EMIC, AT*EXVC, AT*E2APR
NETWORK SERVICES	
Alternate Line Service (ALS)	AT*EALS, AT*ELIN, AT*ESLN
Customer Service Profile	AT*ECSP
Call forwarding	AT+CCFC, AT*EDIF
Calling/called number identification	AT+CLIP, AT+CLIR, AT*EIPS
Preferred networks	AT*EPNR, AT*EPNW
Advice of Charge	AT+CACM, AT+CAMM, AT+CAOC, AT+CPUC
Calling cards	AT*ESCN
Call hold, waiting & multiparty	AT+CCWA, AT+CHLD
Operator selection	AT+COPS
Network registration	AT+CREG
USSD	AT+CUSD, AT+CSSN
Security & Locks	AT+CLCK, AT+CPWD, AT+CPIN, AT*EPEE
SETTINGS	

Restting	AT*EMAR
Ring signal settings	AT*ERIL, AT*ERIN, AT*ERIP, AT*ESIL, AT*ESMA, AT*ESMM, AT*ESOM
ME STATUS INFORMATION	AT*ECAM, AT+CSQ, AT+CIND, AT+CPAS, AT+CMER
ERROR CONTROL	AT+CMEE, AT+CEER
SMS & CB	
Settings	AT*ESTL, AT+CPMS, AT+CRES, AT+CSAS, AT+CSCA, AT+CSMS, AT+CNMI, AT+CSDH, AT+CSMP, AT+CGSMS
SMS-Command	AT+CMGC
Read / write SMS	AT+CMGD, AT+CMGW, AT+CMGL, AT+CMGR
Send SMS	AT+CMGS, AT+CMSS
PHONEBOOK	
Read / write / find	AT+CPBS, AT+CPBR, AT+CPBW, AT+CPBF
Groups	AT*EGIR, AT*ESAG, AT*ESCG, AT*ESDG, AT*ESDI, AT*ESGR
Personal Rings	AT*EPRR, AT*EPRW
Settings	AT*EPBM, AT*E2PBCS
CLOCK	
Alarm	AT+CALA, AT+CALD, AT+CAPD
Time & Date	AT+CCLK, AT+CTZU, AT*EDST
INTERFACE COMMANDS	
Flow control	AT&C, AT&D, AT+ICF, AT+IFC, AT+IPR, AT&S
S registers	ATS0, ATS10, ATS2, ATS3, ATS4, ATS5, ATS6, ATS7, ATS8
Response control	AT+ILRR, ATE, ATV, ATQ, AT+CSCS, ATX
07.10 MULTIPLEXING	AT+CMUX
HSCSD	AT+CHSR, AT+CHSU
GPRS	
PDP Context Activation	AT+CGACT
GPRS Attachment	AT+CGATT
Enter Data State	AT+CGDATA
Define PDP Context	AT+CGDCONT
GPRS Event Reporting	AT+CGEREP

Show PDP Address	AT+CGPADDR
Quality of Service Profile (MINIMUM ACCEPTABLE)	AT+CGQMIN
Quality of Service Profile (REQUESTED)	AT+CGQREQ
GPRS Network registration Status	AT+CGREG
Extension of ATD for GPRS	ATD*
TCP/IP ACCESS	
IP negotiation and address resolution and information	AT*E2IPA, AT*E2IPRH, AT*E2IPI, AT*E2IPE
TCP/UDP connection	AT*E2IPO
Protocol stack settings	AT*E2IPS
TCP listen	AT*E2IPL
NETWORK INFORMATION	
Cell information	AT*E2CD
Engineering Mode	AT*E2EMM
SIM APPLICATION TOOLKIT	
Set Up Call	AT*E2STKC
Display Text	AT*E2STKD
Get Inkey	AT*E2STKG
Get Input	AT*E2STKI
Select Item	AT*E2STKL
Set Up Menu	AT*E2STKM
Envelope (Menu Selection)	AT*E2STKN
Application Toolkit Settings	AT*E2STKS

6 Embedded applications

The module has the capability to store and run customer written code in the form of a script during the processors idle time, through the use of an on board interpreter.

6.1 Features

Main features of embedded applications are as follows.

- C based scripting language (SEM specific).
- Over the air upgradeable (scripts, NOT signalling software)
- Library of intrinsic functions which make full use of the module characteristics and GSM requirements.
- Multiple on module script support (standard configuration is 2).
- 51KB of non volatile data storage in addition to the program memory.

6.2 Implementation

The module has up to 44k of space available for storage of two scripts in the scripting language. Standard C structures are supported enabling most engineers to be immediately familiar with the language.

All hardware interfaces that are normally available to the module through the AT commands are available to the embedded application. Further drivers have been written such as M bus and I^2C for use by the EA through the use of the IO pins.

6.3 Other protocols supported

The unit supports other protocols which enable easier integration using solutions providers through the use of embedded application.

6.3.1 Orange Connect

A number of intrinsic functions have been implemented enabling easy application writing and interfacing to the M2M CONNECT server which is being offered by Orange.

The intrinsic functions that are available offer easy use of configuration settings, server queue management and XML.

6.3.2 IBM MQTT

This is a similar implementation to the Orange connect solution where intrinsic functions are being implemented which enable the unit to easily connect to the IBM broker program allowing the units to subscribe and unsubscribe from groups, also to publish to those groups, etc.

6.4 Limitations

Since the module is processing the script using its own memory, limitations are placed onto the scripts that are run.

- A direct comparison cannot be made to a fully compiled C program in terms of size but a gauge of script size is that if each line were 128 characters long in the script then the script could be 350 lines long.
- Processing power is something that needs to be considered as the script is run as a low priority process within the software. An option that can be used to stop this controller mode, this stops GSM operation and provides all processing power for the script to be run.
- Code cannot be ported directly from an existing application and loaded directly onto the module. It must be re written in the SEM script language so that the module interpreter can function correctly.

6.4.1 M2mpower IDE (Integrated Developers Environment)

The IDE is a windows based package which allows the user to write simulate, de-bug and download their application into a module with the EA software. The standard version is designed to run on Windows XP and 2000, other versions are available for 98 if required.

A guide is available for implementing applications using the developers kit and the EA functionality.

This is a required package to be able to implement an EA.

For further information please contact SEM customer support.

7 TCP/IP stack

An on board IP/TCP/UDP stack has been integrated into the software negating the need for the customer to implement one in their own code base.

This is now available through AT commands and the embedded applications.

7.1 AT command access

Access via the AT commands is detailed in a separate application note and the breakdown of the commands in the integrators manual, these are both available on the extranet.

The way the commands have been structured allows an application that currently uses SMS/CSD/HSCSD to immediately switch over to using GPRS with minimal changes in software. GPRS is on average 1/10th the cost of these other solutions.

Note! The unit is also able to handle circuit switched calls/SMS while in a GPRS session, this also dealt with in the application note referred to above.

7.2 Embedded application Implementation

There are a number commands allowing various functions, these are as follows.

- Open/closing IP connection – Negotiates/closes a dynamic IP address with the server.
- Send/Receive TCP packets – Performs all TCP operations to send and receive packets.
- Send/Receive UDP packets – Performs all UDP operations to send and receive packets.
- Resolve URL to an IP address - Similar to nslookup command in DOS.
- TCP listen – Enabling the unit to be registered on the GPRS network and listen for requests from servers/clients wishing to connect to it.

When the unit is set up and controlled using the embedded applications either the EA or an external application can generate data to be sent and can pass it to the module for transmission.

This effectively provides a transparent communication link to an internet server from the application over GPRS.

8 Technical Data

Mechanical specifications	
Maximum length:	50 mm
Maximum width:	33 mm
Maximum thickness:	6.82 mm (without system connector pins length)
Weight:	18.5 g

Power supply voltage, normal operation	
Voltage:	3.6V Nominal
Tolerance	-0.2 +0.4V
Ripple:	<100mV @ 200KHz, <20mV @>200KHz
Voltage must always stay within a normal operating range, ripple included.	
Power consumption:	Speech mode < 250 mA (< 2 A peak) Idle mode: <5 mA Powered off: < 100 μA*
RTC accuracy:	Max < 37ppm Typical < 20ppm

* The powered off current quoted is with a fully discharged capacitor on the VRTC pin, this reduces to 50uA if no capacitor attached. While powered off the RTC is still running and still able to activate alarms, however the unit is not able to respond to AT commands.

Radio specifications	
Frequency range:	GR 47: GSM 900, EGSM 900 MHz and 1800 MHz (Dual Band) GR 48: GSM 850 MHz and 1900 MHz (Dual Band)
Maximum RF output power:	2 W / 1 W
Antenna impedance:	50 Ω

SIM card	
SIM card interface (external only)	3 V or 5 V

Environmental specifications	
Operating temperature range:	-20 ^{0}C to +55 ^{0}C
Operating temperature (reduced specification)*	-30^0 C to +75^{0}C
Storage temperature range:	-40 ^{0}C to +85 ^{0}C
Maximum relative humidity:	95% at +40 ^{0}C
Stationary vibration, sinusoidal:	Displacement: 7.5 mm Acceleration amplitude: 20 m/s^2 40 m/s^2 Frequency range: 2-8 Hz 8-200 Hz 200-500 Hz

Stationary vibration, random	Acceleration spectral density (m^2/s^2): 0.96 2.88 0.96 Frequency range: 5-10 10-200 200-500 60 min per/axis
Non-stationary vibration, including shock	Shock response spectrum I, peak acceleration: - 3 shocks in each axis and direction: 300 m/s^2, 11 ms Shock response spectrum II, peak acceleration: - 3 shocks in each axis and direction: 1000 m/s^2, 6 ms
Bump:	Acceleration 250 m/s^2
Free fall transportation:	1.2 m
Rolling pitching transportation:	Angle: ±35 degrees, period: 8s
Static load:	10 kPa
Low air pressure/high air pressure:	70 kPa / 106 kPa

*The extended range is defined as -30°C to -20°C and +55°C to +75°C. Operation in these temperature extremes is according to basic minimal performance criteria defined as follows:

- Extended operation in this range shall not cause permanent damage to the unit
- The unit shall be capable of registering with the network and making a call under -85dBm signal conditionals on a high percentage of attempts (>90%)
- The Transceiver and Transmitter shall not violate GMS requirements for spurious emissions, maximum transmit power levels, frequency error, and occupied bandwidth while operating in the extended temperature ranges
- Reduced Transmit output power and reduced receiver sensitivity are possible during operation at these extremes.

Storage	
SMS Storage capacity	40 in ME In addition the unit can handle as many SMS as the SIM can store (SIM dependent).
Phone book capacity	100

DAC		
Parameter	*Value*	*Units*
Resolution	8	bit
Output voltage swing for Code=00_{HEX}	0.138 ± 0.1	V
Output voltage swing for Code=FF_{HEX}	2.61 ± 0.2	V

Nominal Step Size	9.668 ± 0.1	mV
Linear Code Range	8-247 (8_H-$F7_H$)	LSB
Absolute Error during Linear Range	±100	mV
Conversion Speed	<100	µs

ADC

Parameter	*Value*	*Units*
Resolution	8	bit
Input voltage for Code=00_H	0.01 ± 0.01	V
Input voltage for Code=FF_H	2.75 ± 0.1	V
Nominal Step Size	10.742	mV
Accuracy	±3	LSB
Input Impedance	>1	MΩ
Conversion Time to within 0.5bit	<100	µs

9 Contact details

To contact customer support please use the details below.

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GR47/GR48
Integrator's Manual

Sony Ericsson

CE

The GR47 described in this manual conforms to the Radio and Telecommunications Terminal Equipment (R&TTE) directive 99/5/EC with requirements covering EMC directive 89/336/EEC and Low Voltage directive 73/23/EEC. The product fulfils the requirements according to 3GPP TS 51.010-1, EN 301 489-7 and EN60950.

FCC ID: PY76220511-BV

IC: 4170B-6220511

The GR48 described in this manual conforms to the Federal Communications Commission, FCC Rules Parts 22.901d and 24 E and PTCRB NAPRD.03_TC version:
V.2.7.2, 3GPP TS 51.010 Version: 3GPP TS 51.010-1 V.5.6.0

SAR statement: This product is intended to be used with the antenna or other radiating element at least 20 cm away from any part of the human body.

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1 Introduction

1.1 Target Users

The GR47 and GR48 radio devices are designed to be integrated into machine-to-machine or man-to-machine communications applications. They are intended to be used by manufacturers, system integrators, applications developers and developers of wireless communications equipment.

1.2 Prerequisites

It is assumed that the person integrating the radio device into an application has a basic understanding of the following:

- GSM networking;
- Wireless communication and antennas (aerials);
- AT commands;
- ITU-T standard V.24/V.28;
- Micro controllers and programming;
- Electronic hardware design.

1.3 Manual Structure

The manual is composed of three parts:

Part 1- Overview

This section provides a broad overview of the GR47/GR48 family and includes a list of abbreviations used in the manual.

Part 2 - Integrating the Radio Device

This section describes each of the signals available on the GR47/GR48 radio devices, along with mechanical information. The section also provides you with design guidelines and explains what is needed to commercialise an application from a regulatory point of view.

Part 3 - Developer's Kit

This section lists the contents of the Developer's Kit and provides the information to setup and use the equipment.

2 GR47/GR48 Radio Devices

2.1 About the GR47/GR48 Family

Two radio devices make up the family; GR47 and GR48, for use in the E-GSM900/GSM1800 and GSM850/GSM1900 bands respectively.

Note! This manual refers to the GR47 and GR48 as radio devices. If there is a difference in the functionality of the radio devices the GR47 and GR48 information will be listed separately.

The products belong to a new generation of Sony Ericsson radio devices, and are intended to be used in machine-to-machine applications and man-to-machine applications. They are used when there is a need to send and receive data (by SMS, CSD, HSCSD, or GPRS), and make voice calls over the GSM network.

The radio devices can either have applications embedded onto them or they can be used as the engine in an application created by the customer. The radio device can send and receive data when a script is executed, the script can be run internally from the radio device itself or from a micro-controller. A typical application, involves a micro-controller and a radio device, in which the micro-controller sends AT commands to the radio device via an RS232 communications link.

2.2 Radio Devices in a Communication System

Figures 2.1 and 2.2 illustrate the main blocks of a wireless communication system using the radio device. Figure 2.1 shows the communication system when the script is embedded on the radio device and figure 2.2 shows the communication system when a micro-controller is used. They also show the communication principles of the system and the interface between the radio device and the application. The definitions in the figures, as used elsewhere in this manual, are in accordance with the recommendations of GSM 07.07.

- The MS (mobile station) represents the radio device and SIM card. The radio device excluding SIM card, is known as the ME (mobile equipment).
- The DTE (data terminal equipment) is the controlling application. This can be either an external host or an internal embedded application.

- The DCE (data circuit terminating equipment) is the serial communication interface of the MS.

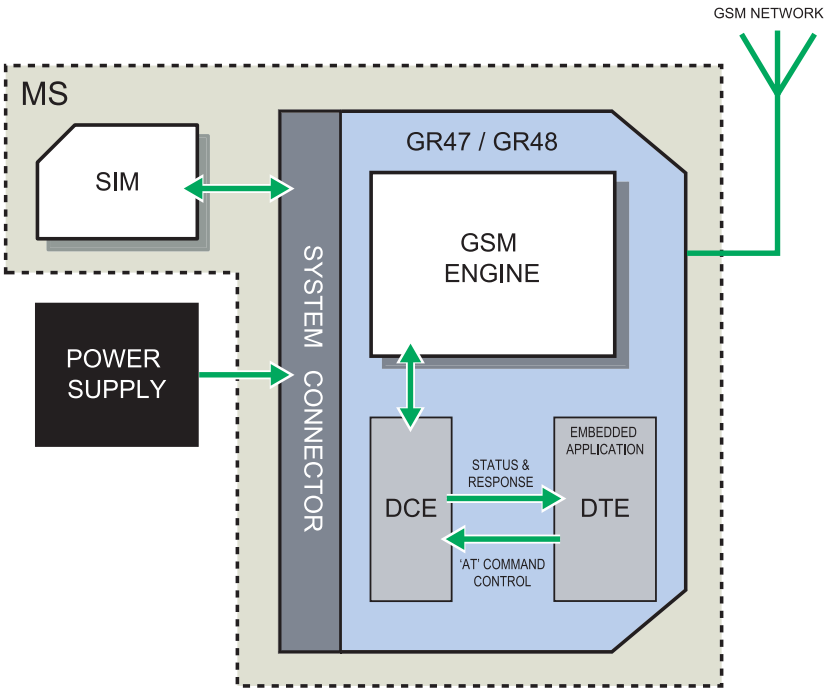

Figure 2.1 Main Blocks in a Wireless System (embedded application)

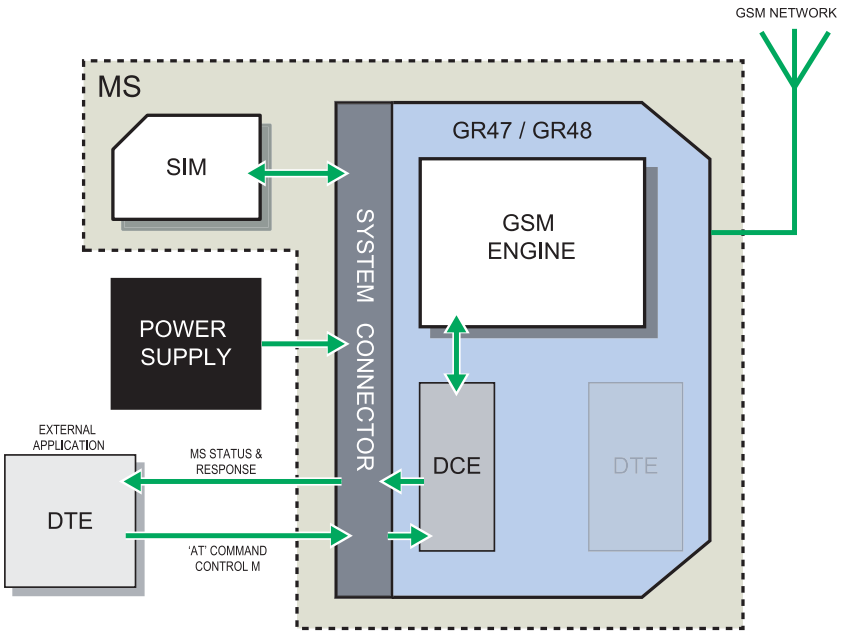

Figure 2.2 Main Blocks in a Wireless System (external micro-controller)

In accordance with the recommendations of ITU-T (International Telecommunication Union - Telecommunications Standardisation Sector) V.24, the TE communicates with the MS over a serial interface.

The functions of the radio device follow the recommendations provided by ETSI (European Telecommunications Standards Institute) and ITU-T.

ETSI specifies a set of AT commands for controlling the GSM element of the radio device; these commands are supplemented by Sony Ericsson specific commands.

To find out how to work with AT commands, see the AT Commands Manual.

2.3 Features

The radio device performs a set of telecom services (TS) according to GSM standard phase 2+, ETSI and ITU-T. The functions of the radio device are implemented by issuing AT commands over a serial interface.

2.3.1 Types of Mobile Station

GR47 and GR48 are dual band mobile stations with the characteristics shown in the tables below.

GR47	*E-GSM 900*	*GSM 1800*
Frequency Range (MHz)	TX: 880-915 RX: 925-960	TX: 1710-1785 RX: 1805-1880
Channel spacing	200 kHz	200 kHz
Number of channels	174 carriers *8 time slots	374 carriers *8 time slots
Modulation	GMSK	GMSK
TX phase accuracy	< 5º RMS phase error (burst)	< 5º RMS phase error (burst)
Duplex spacing	45 MHz	95 MHz
Receiver sensitivity at antenna connector	< –102 dBm	< –102 dBm
Transmitter output power at antenna connector	Class 4 2 W (33 dBm)	Class 1 1 W (30 dBm)
Automatic hand-over between E-GSM 900 and GSM 1800		

GR48	*GSM 850*	*GSM 1900*
Frequency Range (MHz)	TX: 824-849 RX: 869-894	TX: 1850-1910 RX: 1930-1990
Channel spacing	200 kHz	200 kHz
Number of channels	124 carriers *8 time slots	299 carriers *8 time slots
Modulation	GMSK	GMSK
TX Phase Accuracy	< 5º RMS phase error (burst)	< 5º RMS phase error (burst)
Duplex spacing	45 MHz	80 MHz
Receiver sensitivity at antenna connector	< –102 dBm	< –102 dBm
Transmitter output power at antenna connector	Class 4 2W (33 dBm)	Class 1 1 W (30 dBm)
Automatic hand-over between GSM 850 and GSM 1900		

2.3.2 Short Message Service

The radio device supports the following SMS services:

- Sending; MO (mobile-originated) with both PDU (protocol data unit) and text mode supported.
- Receiving; MT (mobile-terminated) with both PDU and text mode supported.
- CBM (cell broadcast message); a service in which a message is sent to all subscribers located in one or more specific cells in the GSM network (for example, traffic reports).
- SMS STATUS REPORT according to GSM 03.40.

The maximum length of an SMS message is 160 characters when using
7-bit encoding. For 8-bit data, the maximum length is 140 characters. The radio device supports up to six concatenated messages to extend this function. Concatenation is disabled if CNMI 3,2 is set (See the AT Commands Manual for further details).

2.3.3 Voice Calls

The radio device offers the capability of MO (mobile originated) and MT (mobile terminated) voice calls, as well as supporting emergency calls. Multiparty, call waiting and call divert features

are available. Some of these features are network-operator specific.

For the inter-connection of audio, the radio device offers both single ended and balanced analogue input and output lines. Direct interface to the digital PCM (pulse code modulation) bus used within the radio device is available, thus by-passing the internal analogue circuitry.

The radio devices support HR, FR and EFR vocoders. The GR48 also supports the Adaptive Multi Rate (AMR) type of vocoder.

2.3.4 Data

The radio device supports the following data protocols:

- GPRS (General Packet Radio Service)
  The radio devices are Class B terminals. The radio devices are GPRS 4+1 enabled, which are capable of receiving at a maximum of four timeslots per frame (down link), and transmitting in one timeslot per frame (up link).
- CSD (Circuit Switched Data)
  The radio devices are capable of establishing a CSD communication at 9.6 kbps.
- HSCSD (High Speed Circuit Switched Data).
  The radio devices support HSCSD communication, with one timeslot per frame capacity in the up link and two timeslots per frame capacity in the down link (2+1).

2.3.5 SIM Card

An external SIM card with 3 V or 5 V technology, can be connected to the radio device via its 60-pin system connector. The unit does not need any external components to enable this.

2.3.6 Power Consumption

		Idle Mode	*Transmit/Operation*
GSM 850 and E-GSM 900	Voice/CSD	< 5 mA	< 250 mA (< 2 A peak)
	Data (GPRS 4+1)	< 5 mA	< 350 mA (< 2 A peak)
GSM 1800 and GSM 1900	Voice/CSD	< 5 mA	< 250 mA (<1.75 A peak)
	Data (GPRS 4+1)	< 5 mA	< 350 mA (<1.75 A peak)

Note! The power consumption during transmission is measured at maximum transmitted power.

2.3.7 Other Features

These include:

- 07.10 multiplexing.
- GPS interoperability.
- SIM application tool kit, class 2 release 96 compliant.
- Embedded application
- On board TCP/IP stack
- AMR (Supported by GR48)

2.4 Service and Support

2.4.1 Web Pages

Visit our web site for the following information:

- where to buy radio devices or for recommendations concerning accessories and components;
- the telephone number for customer support in your region;
- FAQs (frequently asked questions).

The web site address is:

http://www.SonyEricsson.com/M2M

2.4.2 Extranet

The extranet contains all of the more in depth documentation, such as AT commands manual, software bulletins, etc. To gain access to the site please contact either your sales person or customer support.

2.4.3 Integrator's Manual

This manual provides you with all of the information you need to integrate the radio device into your application.

2.4.4 AT Commands Manual

The AT Commands Manual provides you with all the AT commands you can use with your radio device. AT commands are in logical groups and contain the command, a description of its functionality and an example of use.

2.4.5 M2*m*power Application Guide

The M2*m*power Application Guide provides you with all the information you need to build an application using the

M2*m*power support environment. This manual is supplied as part of the M2*m*power package. There are also a number of application notes which accompany the guide showing how to use specific functionality.

2.4.6 Developer's Kit

Sony Ericsson provides the developer's kit to get you started quickly. The kit includes the necessary hardware required to begin the development of an application. It includes the following:

- GSM radio device, GR47 or GR48;
- This Integrator's Manual;
- Developer's kit hardware;
- Developer's kit accessories;
- Power supply
- RS232 cable
- Headset
- Antenna.

All the user needs to provide, is a computer or micro-controller and the expertise to use AT commands.

2.5 Precautions

The radio devices are ESD protected up to 4KV contact and 8KV air discharge. It is recommended that you follow electronic device handling precautions when working with any electronic device system to ensure no damage occurs to the host or the radio device. In "Integrating the Radio Device", page 16 you will find more information about safety and product care. Do not exceed the environmental and electrical limits as specified in Technical Data, page 66.

2.6 Customer support contact details

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3 Abbreviations

Abbreviation	*Explanations*
AMR	Adaptive Multi Rate
ATMS	Audio to Mobile Station
AFMS	Audio from Mobile Station
CBM	Cell Broadcast Message
CBS	Cell Broadcast Service
CSD	Circuit Switched Data
DCE	Data Circuit Terminating Equipment
DK	Developer's Kit
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
EA	Embedded Application
EFR	Enhanced Full Rate
EMC	Electro-Magnetic Compatibility
ETSI	European Telecommunication Standards Institute
FR	Full Rate
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HR	Half Rate
HSCSD	High Speed Circuit Switched Data
IDE	Integrated Development Environment
IP	Internet Protocol
ITU-T	International Telecommunication Union - Telecommunications Standardisation Sector
M2*m*power	Sony Ericsson's powerful support environment
ME	Mobile Equipment
MMCX	Micro Miniature Coax

MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
PCM	Pulse Code Modulation
PDU	Protocol Data Unit
RF	Radio Frequency
RFU	Reserved for Future Use
RLP	Radio Link Protocol
RTC	Real Time Clock
SDP	Service Discovery Protocol
SIM	Subscriber Identity Module
SMS	Short Message Service
TCP	Transport Control Protocol
UDP	User Datagram Protocol

4 Mechanical Description

4.1 Interface Description

The pictures below show the mechanical design of the radio device along with the positions of the different connectors and mounting holes. The radio device is protected with AISI 304 stainless steel covers that meet the environmental and EMC requirements.

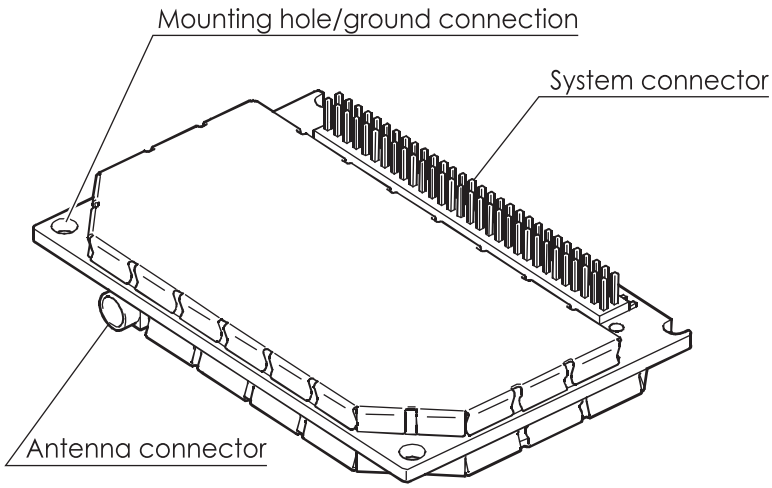


Figure 4.1 Radio Device viewed from below

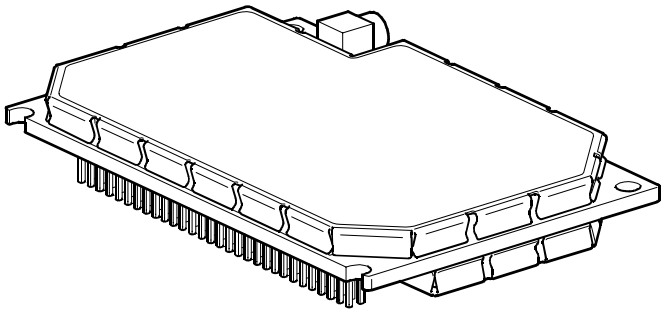


Figure 4.2 Radio Device, viewed from above

Please note the following:

- Mounting holes positioned at the corners make it possible to securely bolt the radio device into your application.

- Keypad, display, microphone, speaker and battery are not part of the radio device.
- The SIM card is mounted in your application, external to the radio device.
- The System Connector is a 60-pin, standard 0.05 in (1.27 mm) pitch type. The pins and their electrical characteristics are described in
  5 System Connector Interface, page 21.
- Information about the Antenna Connector is found in 6 Antenna Connector page 53.

4.2 Physical Dimensions

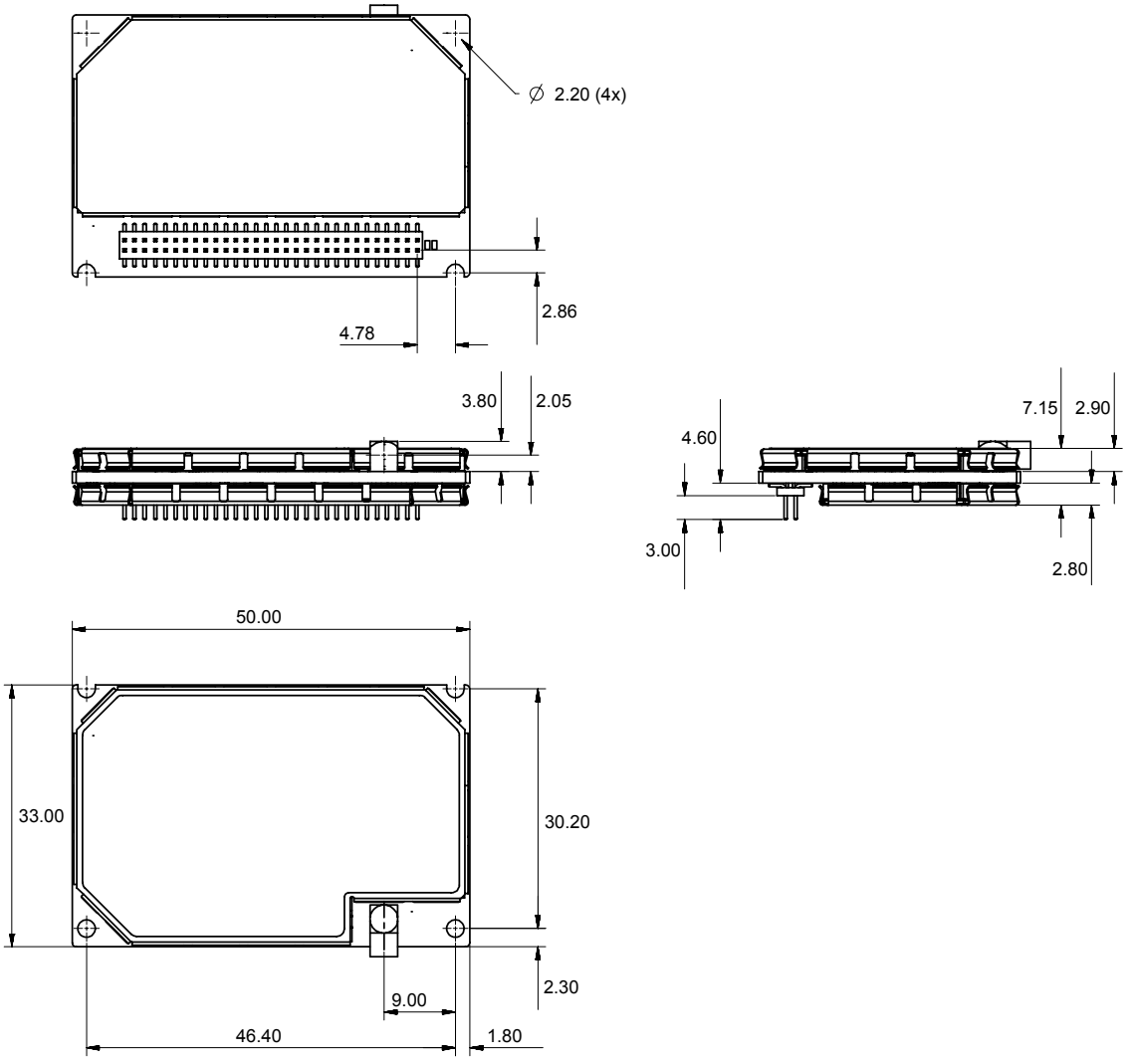


Figure 4.2 Dimensions of the Radio Device

Measurements are given in millimetres. See also Technical Data page 66.

5 System Connector Interface

5.1 Overview

Electrical connections to the radio device (except the antenna), are made through the System Connector Interface. The system connector is a 60pin, standard 0.05 in (1.27 mm) pitch device.

The system connector allows both board-to-board and board-to-cable connections to be made. Use a board-board connector to connect the radio device directly to a PCB, and a board-cable connector to connect the radio device via a cable.

Figure 5.1 below shows the numbering of the connector pins.

A ground connection is provided at the mounting hole next to the RF connector on the radio device as shown below. Connect this ground point to the DGND pins of the radio device by the shortest, low-impedance path possible. The purpose of this connection is to allow any antenna ESD strikes to bypass the radio device's internal ground path.

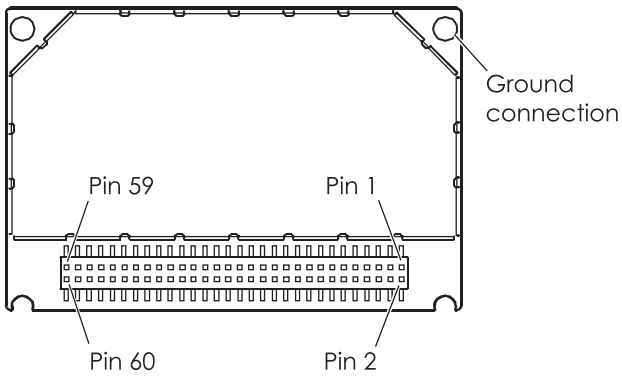


Figure 5.1 Radio Device, viewed from underneath

The following table gives the pin assignments for the system connector interface and a short description for each signal.

Note! Under the heading “Dir” in the table, radio device input and output signals are indicated by the letters I and O respectively.

Pin	*Signal Name*	*Di*	*Signal Type*	*Description*
1	VCC	-	Supply	Power supply
2	DGND	-	-	Digital ground
3	VCC	-	Supply	Power supply
4	DGND	-	-	Digital ground
5	VCC	-	Supply	Power supply
6	DGND	-	-	Digital ground
7	VCC	-	Supply	Power supply
8	DGND	-	-	Digital ground
9	VCC	-	Supply	Power supply
10	DGND	-	-	Digital ground
11	CHG_IN (RFU)	-	Battery charge power	Battery charging
12	DGND	-	-	Digital ground
13	IO5 ADC4	I/0 I	Digital 2.75V Analogue	General purpose input/output 5 Analogue to digital converter 4
14	ON/OFF	I	Internal pull up, open drain	Turns the radio device on and off.
15	SIMVCC	-	Digital 3 V/5 V	SIM card power supply. Power output from radio device for SIM Card
16	SIMPRESENCE	I	Internal pull up, open drain	SIM Presence A “1” indicates that the SIM is missing; a “0” that it is inserted
17	SIMRST	O	Digital 3 V/5 V	SIM card reset
18	SIMDATA	I/	Digital 3 V/5 V	SIM card data
19	SIMCLK	O	Digital 3 V/5 V	SIM card clock
20	DAC	O	Analogue	Digital to analogue converter
21	IO1 KEYROW2	I/ O	Digital 2.75V	General purpose input/output 1 Keyboard row 2
22	IO2 ADC5	I/ O	Digital 2.75V Analogue	General purpose input/output 2 Analogue to digital converter 5
23	IO3 KEYROW3	I/ O	Digital 2.75V	General purpose input/output 3 Keyboard row 3

24	IO4 KEYROW4	I/ O	Digital 2.75V	General purpose input/output 4 Keyboard row 4
25	VRTC	I	Supply 1.8V	Supply for real time clock
26	ADC1	I	Analogue	Analogue to digital converter 1
27	ADC2	I	Analogue	Analogue to digital converter 2
28	ADC3	I	Analogue	Analogue to digital converter 3
29	SDA	I/ O	2.75V, internal pull up	I^2C data
30	SCL	O	2.75V, internal pull up	I^2C clock
31	BUZZER	O	Digital 2.75V	Buzzer output from radio device
32	OUT3 KEYCOL3 DSR	O O O	Digital 2.75V	General purpose output 3 Keyboard column 3 Data set ready (UART1)
33	LED IO6	O I/	Digital 2.75V	Flashing LED General purpose I/O 6
34	VIO	O	Power Out 2.75 V	Radio device power indication. VIO is a 2.75 V at 75 mA output supply that can be used to power external circuitry that interfaces to the radio device
35	TX_ON	O	Digital 2.75V	This output indicates when the GSM radio device is going to transmit the burst
36	RI KEYCOL2 O2	O O O	Digital 2.75V	Ring Indicator (UART1) Keyboard column 2 General purpose output 2
37	DTR KEYROW1 IN1	I I I	Digital 2.75V	Data Terminal Ready (UART1) Keyboard row 1 General purpose input 1
38	DCD KEYCOL1 O1	O O O	Digital 2.75V	Data Carrier Detect (UART1) Keyboard column 1 General purpose output 1
39	RTS IO9	I I/	Digital 2.75V	Request To Send (UART1) General purpose I/O 9
40	CTS KEYCOL4 O4	O O O	Digital 2.75V	Clear To Send (UART1) Keyboard column 4 General purpose output 4
41	TD	I	Digital 2.75V	Transmitted Data (UART1). Data from DTE (host) to DCE (radio device).

42	RD	O	Digital 2.75V	Received Data (UART1). Data from DCE (radio device) to DTE (host).
43	TD3 I/O7	I I/	Digital 2.75V	Transmitted data (UART3) General purpose I/O 7
44	RD3 I/O8	O I/	Digital 2.75V	Received data (UART3) General purpose I/O 8
45	TD2	I	Digital 2.75V	Transmitted data (UART2). Used for flashing the memory.
46	RD2	O	Digital 2.75V	Received data (UART2). Used for flashing the memory.
47	PCMULD	I	Digital 2.75V	DSP PCM digital audio input
48	PCMDLD	O	Digital 2.75V	DSP PCM digital audio output
49	PCMO	O	Digital 2.75V	Codec PCM digital audio output
50	PCMI	I	Digital 2.75V	Codec PCM digital audio input
51	PCMSYNC	O	Digital 2.75V	DSP PCM frame sync
52	PCMCLK	O	Digital 2.75V	DSP PCM clock output
53	MICP	I	Analogue	Microphone Input positive
54	MICN	I	Analogue	Microphone Input negative
55	BEARP	O	Analogue	Speaker output positive
56	BEARN	O	Analogue	Speaker output negative
57	AFMS	O	Analogue	Audio output from radio device
58	SERVICE	I	2.7V	Flash programming voltage for the MS. Enable logger information if not flashing.
59	ATMS	I	Analogue	Audio input to radio device
60	AGND	-	Analogue	Analogue ground

5.2 General Electrical and Logical Characteristics

Many of the signals, as indicated in the table above, are high-speed CMOS logic inputs or outputs powered from a 2.75 V ± 5 % internal voltage regulator, and are defined as Digital 2.75 V. Whenever a signal is defined as Digital 2.75 V, the following electrical characteristics apply.

Parameter	*Min.*	*Max.*	*Units*
High Level Output Voltage (V_{OH}), I_o = –2mA	2.2	2.75	V

Low Level Output Voltage (V_{OL}), I_o = 2mA	0	0.6	V
High Level Input Voltage (V_{IH})	1.93	2.75	V
Low Level Input voltage (V_{IL})	0	0.5	V

Note! Unused pins can be left floating.

5.2.1 General Protection Requirements

- All 2.75 V digital inputs will continuously withstand and suffer no damage in the power-on or power-off condition when subjected to any voltage from - 0.5 V to 3.47 V (3.3 V + 5 %).
- All 2.75 V digital outputs will continuously withstand a short circuit to any other voltage within the range 0 V to 3 V.
- All analogue outputs will continuously withstand a short circuit to any voltage within the range 0 V to 3 V.
- The SIM output signals and the SIMVCC supply will continuously withstand a short circuit to any voltage within the range 0 V to 4.1V.

Note! Although the unit should be able to withstand the higher voltages the unit should not be driven at the levels as it will result in failures over time.

5.3 Grounds

Pin	*Signal*	*Description*
2, 4, 6, 8, 10, 12	DGND	Digital ground
60	AGND	Analogue ground

There are two ground connections in the radio device, AGND (analogue ground) and DGND (digital ground). Pin assignments are shown in the table above.

Note! AGND and DGND are connected at a single point inside the radio device. They must *not* be joined together in your application.

5.3.1 Analogue Ground - AGND

AGND is the return signal, or analogue audio reference, for ATMS (Audio To Mobile Station) and AFMS (Audio From Mobile Station). It is connected to the DGND inside the radio device only. The application must not connect DGND and AGND.

Parameter	*Limit*
I_{max}	≅12.5 mA

5.3.2 Digital Ground - DGND

DGND is the reference or return signal for all system interface digital signals and is also the d.c. return for SERVICE and the power supply, VCC. Connect all DGND pins together in your application in order to carry the current drawn by the radio device.

Parameter	*Per Pin*	*Total (5 Pins)*
I_{max}	< 6.0mA	< 3.0A
I_{avg}	< 100mA	< 600mA

5.4 VCC - Regulated Power Supply Input

Pins	*Signal*	*Description*
1, 3, 5, 7, 9	VCC	regulated power supply input

Power is supplied to the radio device VCC pins, from an external source.

Connect all VCC pins together in your application in order to carry the current drawn by the radio device.

The electrical characteristics for VCC are shown in the table below.

Parameter	*Mode*	*Limit*
Vcc supply voltage	Nominal	3.6 V
	Tolerance including ripple [1]	3.4 V - 4.0 V
	Over-voltage limit	5.5 V
	Maximum ripple	< 100 mV @ <200 kHz; < 20 mV @ > 200 kHz
Maximum allowable voltage drop	Burst transmission	200 mV
Current drawn, at full TX power		< 500 mA (average)
		< 2 A (peak)

[1] Measured at system connector pins.

Note! The radio device has no internal capacitance to supply the large current peaks during GSM burst transmission. We recommend you follow these general guidelines:

- Fit a low ESR electrolytic capacitor close to the radio device:

> 1,000 µF;
< 100 mΩ ESR.

- Make sure power supply to radio device line resistance is < 200 mΩ

5.5 Battery Charging Input (CHG_IN)(Reserved for future use)

For battery powered applications, the radio device has a connection to aid and support battery charging. The typical design where this may be applicable is to power the radio device directly from a battery source connected to VCC (pins 1, 3, 5, 7, 9) and to provide a 5V dc power source (600mA max) to the CHG_IN connection (pin 11). The radio device can control an internal switching FET which creates a charging pathway to the battery. While power is provided at CHG_IN, the battery charge can be maintained. If the power should fail or be removed at CHG_IN, the application will be supported by the battery alone. When CHG_IN voltage returns, the battery charging and maintenance will commence once more.

Battery charging requires additional software functionality which is yet to be released. Once available, the battery charging algorithms and control will only be supported through the Sony Ericsson M2*m*power Embedded Applications.

Caution! Battery charging algorithms are unique to different battery types. Sony Ericsson Mobile Communications will not accept any responsibility or liability for damage, product failures, even death or injury occurring as a result of incompatible battery and charging algorithms being applied without their prior knowledge and consent.

Safety considerations should be taken into account. For example, monitoring the temperature of the battery. If the temperature of the battery exceeds its specification limits, battery charging must be stopped immediately. If the battery temperature continues to rise the application should be suspended or the battery disconnected.

Note! When charging Lithium batteries, the battery pack must have an internal protection circuit in accordance with the manufacturer's instructions.

5.6 Turning the Radio Device ON/OFF and the External Power Signal

Turning the Radio Device On

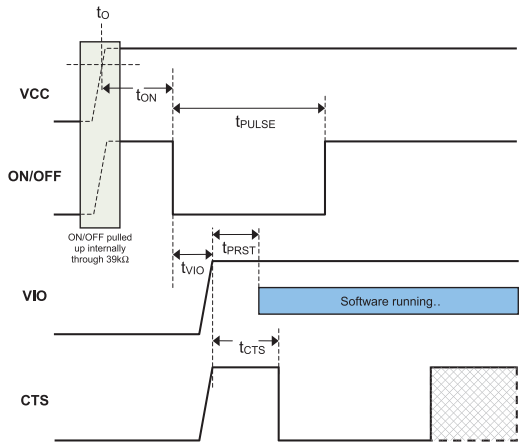


Figure 5.2 On timings and VIO performance

Symbol	*Parameters*	*Conditions*	*Min.*	*Typ*	*Max*	*Unit*
t_0	Reference time when VCC is within working limits (1)	VCC > 3.2V ON/OFF = VCC	-	-	-	-
t_{ON}	Time after t0 when the ON/OFF pulse can begin	VCC > 3.2V	0	-	-	ms
t_{VIO}	Time after start of ON/OFF pulse when VIO is active	VCC > 3.2V	-	45.0	-	ms
t_{PULSE}	Application ON/OFF pulse width	ON/OFF held low until detected by software	400	500	-	ms
t_{PRST}	*I*nternal Power-on reset signal initiates software		100	-	200	ms
t_{CTS}	Time when software controlled CTS signal indicates module READY	CTS signal configured for RS232 hardware flow control, not GPIO pin	-	0.35	3.0(2)	s

(1) The GR47 measures the voltage at VCC during the power-up sequence. It is important that both VCC and ON/OFF reach a minimum of 3.2V before the ON/OFF low pulse is initiated.

(2) In SERVICE mode.

Turning the Radio Device Off

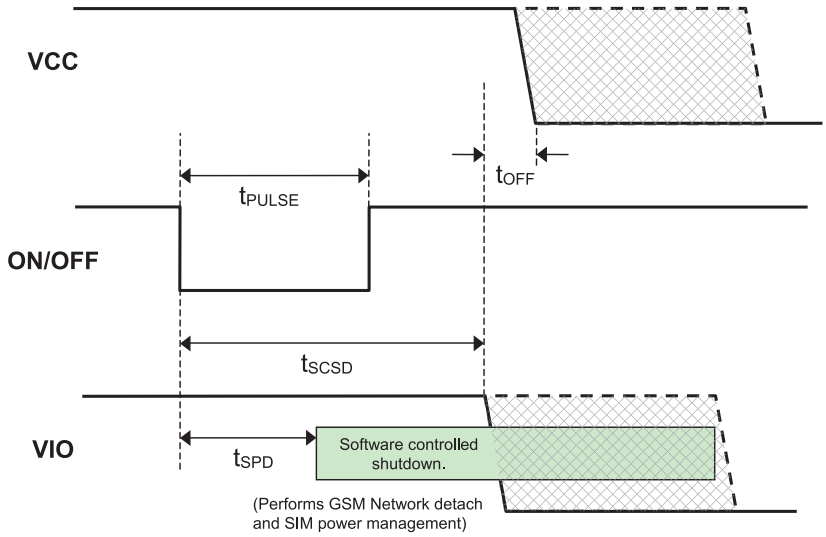


Figure 5.3 Off timings and VIO performance

Symbol	*Parameters*	*Conditions*	*Min.*	*Typ*	*Max*	*Unit*
t_{SPD}	Time for software pulse detection which initiates a software shutdown		800	-	-	ms
t_{PULSE}	Application ON/OFF pulse width		1000	-	-	ms
t_{SCSD}	Software controlled shutdown deactivates VIO (2)		-	2.5	10(3)	s
t_{OFF}	Time when VCC power supply can be disabled	VIO is DISABLED	0	-	-	ms

(2) It is a requirement from most GSM network providers that GSM products properly detach from the network during a power-down sequence. In order to achieve this it is important that the VCC supply is not removed or turned off before VIO has been deactivated by the module.

Hard Shutdown Sequence

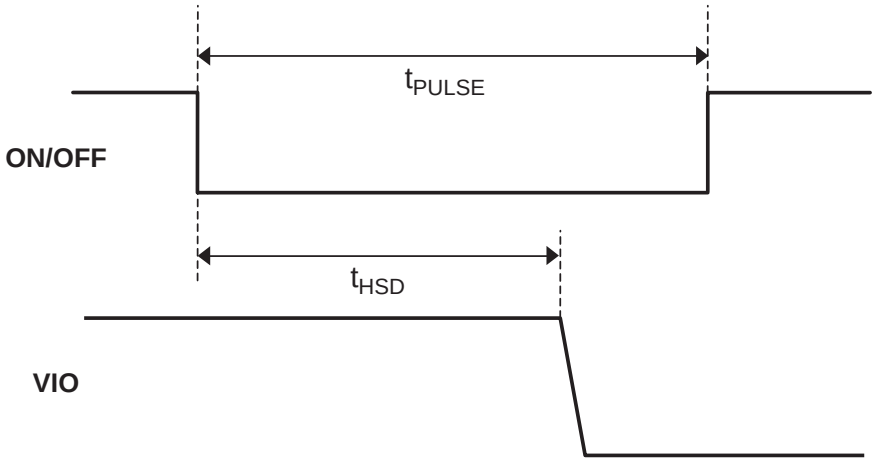


Figure 5.4 Hard Shutdown Sequence

Symbol	*Parameters*	*Conditions*	*Min.*	*Typ*	*Max*	*Unit*
t_{HSD}	Time to complete hardware shutdown		2	-	11	s
t_{PULSE}(4)	Application ON/OFF pulse width	ON/OFF low until VIO is disabled	t_{HSD}	10	-	s

(4) To implement the Hard Shutdown of the GR47, the ON/OFF pulse must be held low until the sequence is complete. Ensure that ON/OFF is not released before VIO has been deactivated by the module.

A hard shut down is only necessary where a normal power down has failed, this should only happen if the software has 'greyed out'. This has never been seen in the modules but is a safety mechanism build into the chipset where the power will be cut from the chips enabling the unit to be powered up normally.

5.6.1 VIO - 2.75V Supply

VIO provides an output voltage derived from an internal 2.75V regulator. Its electrical characteristics are shown below.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Output Voltage (I_{load} = 50 mA)	2.70	2.75	2.85	V
Load current			75	mA

You can use this output for the following:

- to indicate that the radio device is powered;
- to power interface circuits, external to the radio device.

5.7 Analogue Audio

Pin	*Signal*	*Dir*	*Description*
57	AFMS	O	Audio from mobile station
59	ATMS	I	Audio to mobile station
60	AGND	-	Ground (return) for analogue audio

ATMS is the audio input, and AFMS is the audio output, of the radio device. These signals can be used in car kit mode.

There are three factory-set audio profiles:

- portable handsfree
- handset
- car kit

Portable handsfree is the factory-set default profile. The modification, configuration, manipulation and storage of audio profiles is achieved with the AT*E2EAMS (Audio Profile Modification) and AT*E2APR (Audio Profile).

5.7.1 Audio To Mobile Station - ATMS

ATMS is the analogue audio input to the radio device. Internally, the signal is sent to the CODEC (COder/DECoder), where it is converted to digital audio in PCM (Pulse Code Modulation) format. The encoded audio is sent to PCMOUT via the internal PCM bus.

ATMS provides a DC bias when it is used as the microphone input in Portable Handsfree applications. All other sources must be a.c.coupled to avoid attenuation of low frequencies, and to prevent incorrect biasing or damage to the ATMS input. Use a capacitor greater than the value shown in the table below.

The ATMS input is a passive network followed by the transmit part of the CODEC.

Parameter		*Limit*
Application driving impedance (0.3 - 3.5 kHz)		≤ 300 Ω
AC coupling capacitance		≥ 1 µF
Radio device input impedance (0.3 - 3.5 kHz)		> 50 kΩ
Low frequency cut-off (- 3 dB)		300 Hz ± 50 Hz
High frequency cut-off (– 3 dB)		> 3500 Hz ± 50 Hz
Output d.c. bias level	car kit mode	0 V

Additional Gain in car kit mode	28.5 dB

The following tables show the nominal PGA (programming gain settings). For more information see the relevant AT commands.

Maximum input voltage limit: 245 mV_{rms}

Input	*Input (mV_{rms})*	*TXAGC (dB)*	*AUX AMP gain*	*PCMOUT (dBm0)*
ATMS	245	0	13	3

Maximum input level at MICI, 61.4 mV_{rms} output at PCMOUT = 3 dBm0

Input	*Differential input (mV_{rms})*	*TXAGC (dB)*	*AUX AMP gain*	*PCMOUT (dBm0)*
MICN MICP	61.4	0	25	3

Output at AFMS for 3 dBm0 at PCMIN

Input	*dBm0*	*RXPGA*	*Volume control (dB)*	*AFMS (mV_{rms})*
PCMIN	3	0	0	436

Output at BEARN/BEARP for 3 dBm0 at PCMIN

Input	*dBm0*	*RXPGA*	*Volume control (dB)*	*BEAR (mV_{rms})*
PCMIN	3	0	0	388

5.7.2 Audio From Mobile Station - AFMS

AFMS is the analogue audio output from the radio device and may be used to drive a speaker or the ear-piece in a car kit.

PCM digital audio signals, entering the radio device through the PCMIN pin, are translated to analogue signals by the CODEC. See *PCM Digital Audio* for further information.

The table below shows the audio signal levels for AFMS.

Parameter	*Limit*
Speaker impedance	64 Ω to 1 kΩ
Output Capacitance	2.2 µF ±10 %

Levels (THD < 5 %)	Drive capability into 5 kΩ (0.3 - 3.5 kHz)	> 2.4 V_{p-p}
	Drive capability into 1.5 kΩ (0.3 - 3.5 kHz)	> 2.2 V_{p-p}
	Drive capability into 150 Ω (at 1 kHz)	> 1.3 V_{p-p}

5.7.3 Microphone Signals

Pin	*Speaker signals*	*Dir*	*Function*
53	MICP	I	Microphone positive input
54	MICN	I	Microphone negative input

MICP and MICN are balanced differential microphone input pins. These inputs are compatible with an electret microphone. The microphone contains an FET buffer with an open drain output, which is supplied with at least +2 V relative to ground by the radio device as shown below.

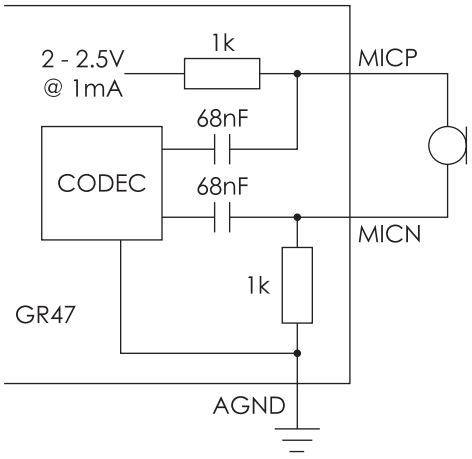


Figure 5.5 Microphone connections to the radio device

5.7.4 Speaker Signals

Pin	*Speaker signals*	*Dir*	*Function*
55	BEARP	O	Speaker positive output
56	BEARN	O	Speaker negative output

BEARP and BEARN are the speaker output pins. These are differentialmode outputs. The electrical characteristics are given in the table below.

Parameter	*Limit*
Output level (differential)	≥ 4.0 V_{pp}
Output level (dynamic load = 32 Ω)	≥ 2.8 V_{pp}
Gain PCMIN[5] to BEARP/BEARN (differential)	– 9 dB ± 1
Distortion at 1 kHz and maximum output level	≤ 5 %
Offset, BEARP to BEARN	± 30 mV
Ear-piece mute-switch attenuation	≥ 40 dB

[5] See PCMIN signal in.

The following table shows the ear piece impedances that can be connected to BEARP and BEARN.

Ear piece model	*Impedance*	*Tolerance*
Dynamic ear piece	[32 Ω + 800 µH] // 100 pF	± 20 %
Dynamic ear piece	[150 Ω + 800 µH] // 100 pF	± 20 %
Piezo ear piece	1 kΩ + 60 nF	± 20 %

5.8 PCM Digital Audio

Pin	*Signal*	*Dir*	*Function*
52	PCMCLK	O	PCM clock
51	PCMSYNC	O	PCM frame sync
47	PCMULD	I	PCM audio input to DSP
48	PCMDLD	O	PCM audio output from DSP
50	PCMIN	I	PCM audio input to Codec
49	PCMOUT	O	PCM audio output to Codec

Figure 5.6 shows the PCM (Pulse Code Modulation) digital audio connection for external devices. These connections can be used to process PCM digital audio signals, bypassing the radio device's internal analogue audio CODEC.

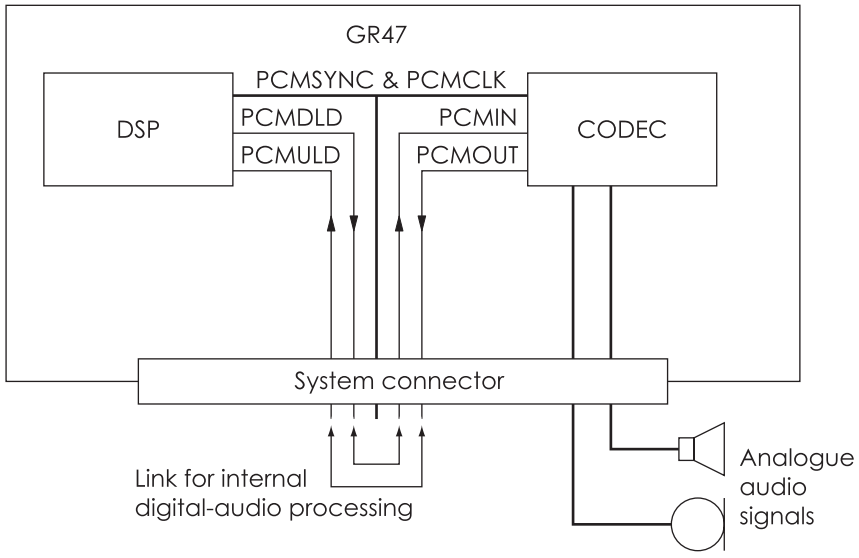


Figure 5.6 Pin connections to digital audio

Note! When no external audio processing is performed, the following pins must be connected together:

- PCMDLD to PCMIN
- PCMULD to PCMOUT

Electrical characteristics

Digital 2.75 V CMOS input/output electrical characteristics apply.

5.8.1 PCM Data Format

All of the radio device's PCM signals, including signals between its CODEC and DSP conform to the PCM data I/O format of the industry standard DSP from Texas Instruments.

PCMCLK (bit clock) and PCMSYNC (frame synchronisation) are both generated by the DSP within the radio device.

The DSP within the radio device is the master therefore all external PCM clocks and data from external devices must be synchronized to it

13-Bit PCM Mode

Bit	*Contents*
D15 to D14	Equal to D13
D13 to D1	Two's complement of the 13-bit PCM
D0	LSB, not used

The radio device implements 13-bit PCM with the 13-bit data embedded in a 16-bit word within a 24-bit frame (see Figure 5.8). Each PCM word contains 16-bits: D0 to D15. D13 to D1 is the two's complement value of the 13-bit PCM, with D13 as the sign bit. D14 and D15 are always set to be equivalent with D13. D0, the LSB, is not used as shown in Figure 5.7 below.

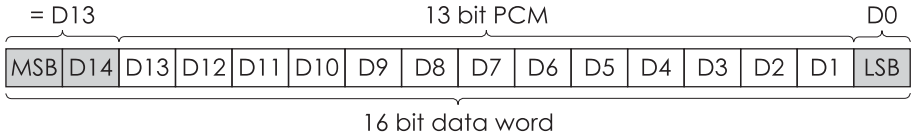


Figure 5.7 16-bit data word format

16-Bit PCM Mode

Bit	*Contents*
D15 - D0	Two's complement

The frame format is equal to the one shown in Figure 5.7, but with D15, D14 and D0 filled with significant bits. D15 to D0 is the two's complement value of the 16-bit PCM with bit 15 as the sign bit.

PCM Timing Diagrams

The PCM timing is shown in Figure 5.8below and it is seen that the CPU has 45 µs to serve an interrupt and setup data channels. Data is sent on the falling edge of the sync pulse. The data bits in PCMULD and PCMDLD are aligned so that the MSB in each word occurs on the same clock edge as shown in Figure 5.9.

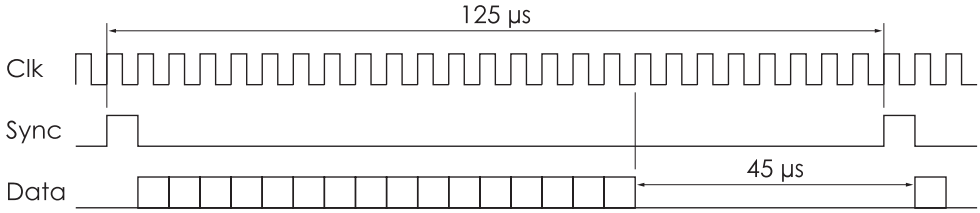


Figure 5.8 16-bit word within 24-bit frame

PCM signal timing is shown in Figure 5.9. The signals characteristics are described in the tables following Figure 5.9.

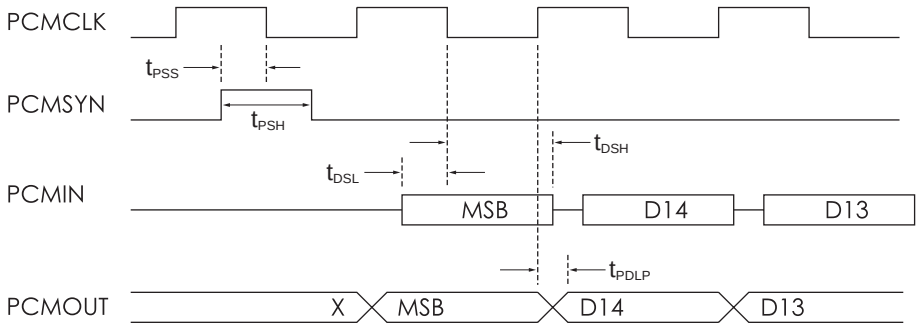


Figure 5.9 PCM Timing Diagram

Name	*Description*	*Typ.*	*Unit*
t_{PSS}	PCMSYN (setup) to PCMCLK (fall)	2.5	µs
t_{PSH}	PCMSYN pulse length	5	µs
t_{DSL}	PCMI (setup) to PCMCLK (fall)	2.5	µs
t_{DSH}	PCMI (hold) from PCMCLK (fall)	2.5	µs
t_{PDLP}	PCMO valid from PCMCLK (rise)	2.5	µs

Name	*Description*	*Typ.*	*Unit*
F_{PCMCLK}	PCM clock frequency	200	kHz

T_{PCMCLK}	PCM clock period with 50/50 mark space ratio	5	µs
F_{PCMSYN}	PCM sync frequency	8	kHz

Typical Rise/Fall times	*Rise Time*	*Fall Time*	*Unit*
PCMCLK	19	18	ns
PCMSYN	19	15	ns
PCMOUT	900	900	ns
PCMDLD	20	19	ns

5.9 Serial Data Interfaces

Pin	*Signal*	*Dir*	*Description*	*RS232 CCITT*
41	TD	I	Serial data to radio device (UART1)	103
42	RD	O	Serial data from radio device (UART1)	104
39	RTS IO9	I I/O	Request To Send (UART1) General purpose input/output 9	105
40	CTS KeyCOL4 O4	O O O	Clear To Send (UART1) Key column 4 General purpose output 4	106
37	DTR KeyROW1 IN1	I I	Data Terminal Ready (UART1) Keyboard row 1 General purpose input 1	108.2
32	DSR KeyCOL3 O3	O O O	Data Set Ready (UART) Key column 3 General purpose output 3	107
38	DCD KeyCOL 1 O1	O O O	Data Carrier Detect (UART1) Key column 1 General purpose output 1	109
36	RI KeyCOL 2 O2	O O O	Ring Indicator (UART1) Key Column 2 General output 2	125
45	TD2	I	Transmitted Data (UART2)	
46	RD2	O	Received Data (UART2)	
43	TD3	I	Transmitted Data (UART3)	
44	RD3	O	Received Data (UART3)	

The serial channels, consisting of three UARTs, are asynchronous communication links to the application or accessory units.

- UART1 has RS-232 functionality and is used for all on- and off -line communication.
- UART2 behaves as a general-purpose serial data link. For example, it can be used for GPS, downloading software and receiving logging information.
- UART3 behaves as a general purpose serial data link. It is the only UART that can be used by the embedded application.

Note! Digital 2.75V CMOS input/output electrical characteristics apply.

The standard character format consists of 1 start bit, 8 bit data, no parity and 1 stop bit. In all, there are 10 bits per character.

5.9.1 UART1 (RS232) - RD, TD, RTS, CTS, DTR, DSR, DCD and RI

UART1 signals conform to a 9-pin RS232 (V.24) serial port.

Note! UART1 signal levels do not match standard RS232 (V.28) levels. The relationship between the levels is shown in the table below.

RS232 level	*RD, TD*	*RTS, CTS, DTR, DSR, DCD,*	*CMOS level*
< – 3 V	1	OFF	> 1.93 V
> + 3 V	0	ON	< 0.80 V

Conversion between the radio device CMOS levels and RS232 levels can be achieved using a standard interface IC, such as the Maxim Integrated Products MAX3237.

5.9.2 Serial Data Signals - RD, TD

The default baud rate is 9.6 kbits/s, however higher bit rates of up to 460 kbits/s are supported, set by an AT command. UART1 starts at a rate of 9.6 kbits/s in standard AT command mode. The radio device also supports GSM 07.10 multiplexing protocol and starts when the appropriate command is sent.

Serial Data From Radio Device (RD)

RD is an output signal that the radio device uses to send data via UART1 to the application.

Parameter	*Limit*
Application load resistance	< 100 kΩ
Application load capacitance	< 100 pF

Serial Data To Radio Device (TD)

TD is an input signal, used by the application to send data via UART1 to the radio device.

Parameter	*Limit*
Application driving impedance	< 100 Ω
Input capacitance	1nF
Input resistance	100 kΩ to 2.75 V

5.9.3 Control Signals - RTS, CTS, DTR, DSR, DCD, RI

UART1 control signals are active low and need a standard interface IC, such as the MAX3237, to generate standard RS232 levels.

UART1 converted signals, together with DGND, RD and TD form a 9pin RS232 data port.

RTS and CTS are capable of transmitting at $1/10^{th}$ of the data transmission speed for data rates up to 460 kbit/s (byteoriented flow control mechanism).

Note! When hardware flow control is not used in communications between the application and the radio device, RTS and CTS must be connected to each other at the radio device.

Switching times for RTS and CTS

The table below shows the switching times.

Parameter	*Limit*
Time from Low to High level	< 2 µs
Time from High to Low level	< 2 µs

Request to Send (RTS)

Used to condition the DCE for data transmission. The default level is high by internal pull up.

The application must pull RTS low to enable data transmission from the radio device. Similarly, the radio device asserts CTS low, indicating it is ready to receive data transmission from the host.

Parameter	*Limit*
Application driving impedance	< 100 Ω

Input capacitance	< 2 nF
Input resistance (pull-up)	100 kΩ to DGND

Clear To Send (CTS)

CTS is asserted by the DCE to indicate that the host (DTE) may transmit data. When CTS is high, the host (DTE) is not permitted to transmit data.

The table below shows the load characteristics for this signal.

Parameter	*Limit*
Application load capacitance	< 500 pF
Application load resistance	≥ 1 MΩ

Data Terminal Ready (DTR)

DTR indicates that the DTE is ready to receive data. It also acts as a hardware ‘hang-up’, terminating calls when switched high. The signal is active low. You can define the exact behaviour of DTR with an AT command.

Data Set Ready (DSR)

DSR indicates that the DCE is ready to receive data. The signal is active low.

Data Carrier Detect (DCD)

DCD indicates that the DCE is receiving a valid carrier (data signal) when low.

Ring Indicator (RI)

RI indicates that a ringing signal is being received by the DCE when low. You can define the exact behaviour of RI with an AT command.

5.9.4 UART2 - TD2, RD2

UART 2 consists of a full duplex serial communication port with transmission and reception lines.

This communication port works in a mode called Operation and Maintenance.

Operation and Maintenance mode works in combination with the SERVICE signal. Two events are possible if the SERVICE signal is active when the radio device is turned on. These are:

- the radio device is reprogrammed if UART2 is connected to a computer running Sony Ericsson update software;
- the radio device enters logging mode and sends data to UART2 if no reprogramming information is received.

Timing and electrical signals characteristics are the same as for UART1, TD and RD, except for maximum baud rate which could increase to 921 kbps.

Transmitted Data 2 (TD2)

TD2 is used by the application to send data to the radio device via UART2. It has the same electrical characteristics as TD.

Received Data 2 (RD2)

RD2 is used to send data to the application via UART2. It has the same electrical characteristics as RD.

5.9.5 UART3 - TD3, RD3

UART3 is a full duplex serial communication port with transmission and reception lines. It has the same timing and electrical signal characteristics as UART1, TD and RD.

Transmitted Data 3 (TD3)

TD3 is used by your application to send data to the radio device via UART3.

Received Data 3 (RD3)

RD3 is used to send data to your application via UART3.

5.10 SIM Card Related Signals

Pin	*Signal*	*Dir*	*Description*
15	SIMVCC	-	SIM card power supply
16	SIMPRESENCE	I	SIM card presence
17	SIMRST	O	SIM card reset
19	SIMCLK	O	SIM card clock
18	SIMDATA	I/O	SIM card data

These connections allow you to communicate with the SIM card holder in your application.

Note! The distance between the SIM card holder and the radio device can be up to 25cm.

This SIM interface allows the use of 3 V and 5 V SIM cards. By default it works on 3 V levels but will automatically switch to 5 V, if a 5 V SIM card is fitted.
SIM voltage levels, as shown in the following table, are dependent on the type of SIM card detected by the radio device.

Signal	*Parameter*	*Mode*	*Min.*	*Typ.*	*Max.*	*Unit*
SIMVCC	SIM supply voltage	3 V	2.7	3.0	3.3	V
		5 V	4.5	5.0	5.5	V
SIMDAT	High Level Input voltage (V_{IH})	3 V	2.1		3.0	V
		5 V	3.5		5.0	V
SIMDAT	Low Level Input voltage (V_{IL})	3 V	0		0.9	V
		5 V	0		1.5	V
SIMDAT	High Level Output voltage (V_{OH})	3 V	2.7		3.0	V
		5 V	4.7		5.0	V
SIMDAT	Low Level Output voltage (V_{OL})	3 V	0		0.2	V
		5 V	0		0.2	V
SIMCLK SIMRST	High Level Output voltage (V_{OH})	3 V	2.4		3.0	V
		5 V	4.4		5.0	V
SIMCLK SIMRST	Low Level Output voltage (V_{OL})	3 V	0		0.35	V
		5 V	0		0.3	V

5.10.1 SIM Detection - SIMPRESENCE

SIMPRESENCE is used to determine whether a SIM card has been inserted into or removed from the SIM card holder. You should normally wire it to the “card inserted switch” of the SIM card holder, but different implementations are possible.

When left open, an internal pull-up resistor maintains the signal high and means “SIM card missing” to the radio device. When pulled low the radio device assumes a SIM card is inserted.

SIMPRESENCE is a Digital 2.75V CMOS input with the following electrical characteristics.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Pull-up resistance (at 2.75 V)	100			kΩ
Low Level Input voltage (SIM inserted)			0.80	V
High Level Input voltage (SIM missing)	> 1.93		2.75	V

Note! To meet regulatory approvals SIMPRESENCE must be implemented.

5.11 Service/Programming

Pin	*Signal*	*Dir*	*Description*
58	SERVICE	I	Flash programming voltage

When the SERVICE input signal is active the radio device will:

- be reprogrammed if data is received through UART2 from a computer running Sony Ericsson reprogramming software;
- or it will output logging data on UART2.

The electrical characteristics are given below. The signal reference is DGND.

Mode	*SERVICE Voltage (V)*			*Drive Capacity*
	Min.	*Typ.*	*Max.*	
Normal Operation			0.8	-
Service/enable programming	1.9	2.75V	3.6	> 1 mA
Absolute maximum voltage			13.5	

5.12 Buzzer

Pin	*Signal*	*Dir*	*Description*
31	BUZZER	O	Buzzer output from radio device

Connecting the BUZZER signal to an inverting transistor-buffer followed by a piezoelectric transducer enables the radio device to play pre-programmed melodies or sounds.

5.13 LED

Pin	*Signal*	*Dir*	*Description*
33	LED	O	LED Output from radio device

The LED states shown below, are hard coded

LED indication	*Operational status*
No indication	No power or in the OFF state
Green, steady	Power on, not connected to a network
Green, blinking	Power on, connected to a network

The following circuit is recommended for connecting an LED.

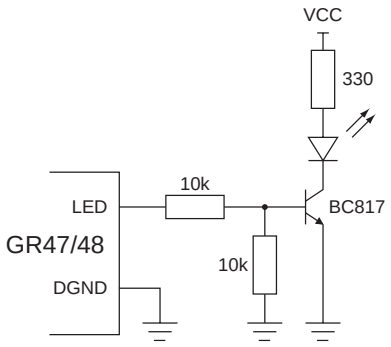


Figure 5.10 Electrical connections for the LED

5.14 General Purpose Digital I/O Ports

Pin	*I/O port signal*	*Default signal*	*Description*
21	IO1	IO1	Programmable Input/Output 1 KEYRow2
22	IO2	IO2	Programmable Input/Output 2 ADC5
23	IO3	IO3	Programmable Input/Output 3 KEYRow3
24	IO4	IO4	Programmable Input/Output 4 KEYRow4
13	IO5	IO5	Programmable Input/Output 5 ADC4
33	IO6	LED	Programmable Input/Output 6/LED
43	IO7	TD3	Programmable Input/Output 7/TD3
44	IO8	RD3	Programmable Input/Output 8/RD3
39	IO9	RTS	Programmable Input/Output 9/RTS
37	IN1	DTR	Programmable Input 1 Data Terminal Ready
32	OUT3	DSR	Programmable Output 3/DSR

36	OUT2	RI	Programmable Output 2/RI Ring Indicator
38	OUT1	DCD	Programmable Output 1/DCD Data Carrier Detect
40	OUT4	CTS	Programmable Input/Output 4/CTS

Signals which have an entry in the Default Signal column in the above table are multiplexed.

The operational modes of multiplexed signals are controlled by AT commands and also by intrinsic functions available to an embedded application.

The following table gives you the input impedance. These values only apply when the ports are configured as input signals.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Input impedance (pull-up)	50	100	120	kΩ

Note! I/O6 (LED) doesn't have an internal pull up. If this pin is configured as an input, it should not be left floating.
I/O7 (TD3) has a pull down instead of a pull up.

5.15 Extended I/O capabilities

To increase flexibility and variety of radio device peripherals, the RS232 hardware flow control shares its physical interface with the keypad scanning interface and the extended general purpose I/O capability. This sharing means that it is not feasible to operate all these features concurrently, however, with care, dynamic switching from one feature to another is possible.

Using Embedded Applications

When a particular I/O feature is required, the user sets the state of the relevant I/O blocks by disabling one set before enabling others.

The radio device checks the state of the I/O when the user requests a new function. The new function is rejected if the current function is not released first.

Note! Only the states of I/O1 - I/O5 are retained for the next power up. For example, inputs remain as inputs and outputs remain as outputs. The voltage of a defined output pin will still drop to 0 Volts in the radio device power down state.

5.15.1 LED/IO6 Capabilities

The LED function pin can be used as a general purpose digital I/O when the flashing LED function is not required. However, this pin does not have an on-board pull-up resistor. It is required that an external pull-up or pull-down resistor be provided by the host circuitry when either not used or when used as a digital input.

5.15.2 I#/O#

If pins labelled I# and O# are not being used for an alternative function they may be used for general purpose inputs or outputs respectively. The inputs have an on-board 100k pull-up resistor and the outputs are driven rail-to-rail at 2.75V levels.

5.15.3 UART3/IO#

The UART3 pins have been given alternative functions as general purpose I/O, both pins may be used for either input or output. However, the TX pin has a 100kΩ pull-down resistor to ground and the RX pin has a 100kΩ pull-up resistor to 2.75V. This must be taken into consideration when designing the host circuit.

5.15.4 IO#/ADC#

To increase analog input capabilities, the radio device optimises the I/O by multiplexing or sharing different features on single pins. There are two digital I/O pins which now have an additional ADC input. When configured as digital I/O, the software will not read the voltages at the two new ADC inputs. When configured as ADC inputs the software will configure the digital I/O pins as input or high impedance tri-state. In this state any applied voltage between 0V and 2.75V can be read as an 8 bit value.

Because the additional ADC inputs (ADC4 and ADC5) are common with digital I/O, the input circuit of the ADC is not the same as for the original circuits ADC1-3. It is important to understand the input structure of the pin so that the correct analog voltage is read by the application.

5.16 General Purpose Analogue I/O Ports

Pin	*Signal*	*Dir*	*Description*
20	DAC	O	Digital to analogue conversion output
26	ADC1	I	Analogue to digital conversion input 1

27	ADC2	I	Analogue to digital conversion input 2
28	ADC3	I	Analogue to digital conversion input 3
13	ADC4 (I/O5)	I (I/O)	Analogue to digital conversion input 4
22	ADC5 (I/O2)	I (I/O)	Analogue to digital conversion input 5

The radio device is able to convert digital to analogue signals and vice versa.

5.16.1 Digital to Analogue Converter - DAC

The DAC is an 8-bit converter. Conversion takes place when an AT command is sent to the radio device. The radio device sends the resulting analogue value to the DAC pin.

Tolerance on this internal voltage is ±5%.

DAC output electrical characteristics are given in the following table.

Parameter	*Limit*	*Units*
Resolution	8	Bits
Output voltage for code = 0	(2.75[6] x 0.05) ± 0.05	V
Output voltage for code = 255	(2.75[6] x 0.95) ± 0.05	V
Nominal step size	(2.75[6] x 0.9)/256	mV
Absolute error[7]	≤ ± 0.5	mV
Output wide-band noise and clock feedthrough 0 - 1.1 MHz	≤ 0.5	mV_{rms}
Power-supply rejection ratio 50 Hz - 10 kHz	≥ 40	dB
Conversion rate ± 0.5 LSB	≤ 2 (Load A)[8]	ms
	≤ 50 (Load B)[8]	ms
Output buffer impedance when disabled	≥ 50	kΩ
Output current source or sink	≥ 1	mA
Current consumption (active)	≤ 1.0	mA

[6]Tolerance on this internal voltage is ± 5 %

[7]Referred to the ideal conversion characteristic.

[8]See Figure 5.11

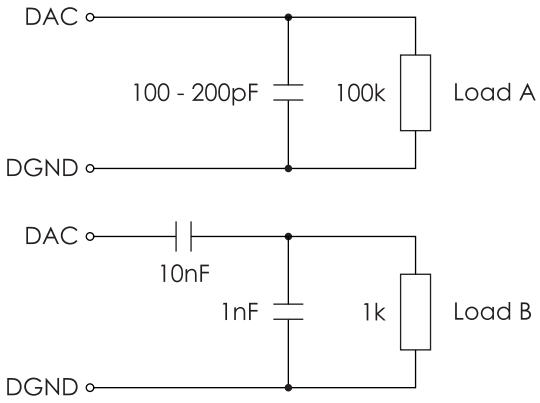


Figure 5.11 DAC loads

5.16.2 Analogue to Digital Converters 1, 2 and 3 - ADCx

The ADC is an 8-bit converter. An analogue value applied to any of the ADC pins is converted and stored in a register inside the radio device. When the appropriate AT command is received by the radio device, the digital value stored in the register is read.

ADC electrical characteristics are shown in the table below.

Parameter	*Min.*	*Max.*	*Units*
Resolution	8	8	Bits
Input voltage for 0000 0000 word	0	0.01 x 2.75[9]	V
Input voltage for 1111 1111 word	0.99 x 2.75[9]	2.75[9]	V
Differential Non-Linearity (DNL)		±0.75	LSB
Overall Non-Linearity (INL)		±0.60	LSB
Absolute accuracy		±1.5	LSB
Input impedance	1		MΩ
Average supply current (continuous conversion)		1	mA
External source impedance		50	kΩ

[9] Tolerance on this internal voltage is ±5%

5.16.3 Analogue to Digital Converters 4 and 5 - IOx/ADCx

To increase analog input capabilities, the GR47 optimises the I/O by multiplexing or sharing different features on single pins. There are two ADC inputs which share system connector pins with digital I/O signals. When configured as digital I/O, the

software will not read the voltages at the two new ADC inputs. When configured as ADC inputs the software will configure the digital I/O pins as input or high impedance tri-state. In this state any applied voltage between 0V and 2.75V can be read as an 8 bit value.

Because the ADC inputs, ADC4 and ADC5, are common with digital I/O, the input circuit of these ADCs is not the same as for the circuits ADC1, ADC2 and ADC3. It is important to understand the input structure of the pin so that the correct analog voltage is read by the application (at position 'A' in Figure 5.12 below). The input structure is provided in Figure 5.12. It consists of a 100kΩ pull-up to 2.75V followed by a series 10kΩ and 1nF capacitor to ground which make a low pass filter with a 3dB roll-off at about 16kHz. The input impedance of the analog IC is 1MΩ minimum. At position 'A' in Figure 5.12 below, the input characteristics are the same as for the table above.

Note! If the voltage of the signal to be measured may be altered by the internal circuitry of this shared signal, then the application should use ADC1, ADC2 or ADC3 instead.

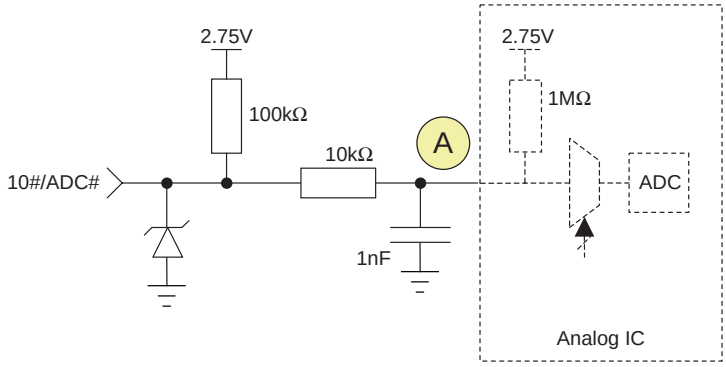


Figure 5.12 Input circuit for combined digital I/O and ADC pins

5.17 External I²C Serial Control Bus

Pin	*Signal*	*Dir*	*Description*
29	SDA	I/O	I²C serial data
30	SCL	O	I²C serial clock

The I²C bus is controlled by embedded application script commands it is not available in the GM47r5.

The external I²C bus consists of two signals, SDA and SCL. This bus is isolated from the radio device's internal I²C bus to ensure proper operation of the radio device, in the event of the external I²C bus being damaged.

The electrical characteristics are shown below.

	Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Transmit operation	Frequency I²C CLK	81.25		400	kHz
	High or low I²C CLK	1.2			µs
	Delay time after falling edge of I²C CLK	308	308-1230		ns
	Hold time after falling edge of I²C CLK	0			ns
Receive operation	Frequency I²C CLK			400	kHz
	High or low I²C CLK	1.2			µs
	Delay time after falling edge of I²C CLK	100			ns
	Hold time after falling edge of I²C CLK	0			ns

5.18 TX_ON - Burst Transmission

Pin	*Signal*	*Dir*	*Description*
35	TX_ON	O	GSM radio device to transmit

Burst transmission is the time when a GSM transceiver unit is transmitting RF signals. TX_ON indicates the radio device is going into transmission mode.

5.19 Real Time Clock

Pin	*Signal*	*Dir*	*Description*
25	VRTC	-	Voltage for the Real Time Clock

The Real Time Clock (RTC) provides the main microprocessor with a time-of-day calendar and alarm, and a one-hundred-year calendar. Its accuracy is shown in the table below

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
RTC accuracy	25ûC	8 (21)	20 (52)	ppm (s/month)
RTC accuracy	extreme temperatures	89 (231)	101 (262)	ppm (s/month)

The Real Time Clock operates in two modes when connected to a separate power supply:

- RTC normal mode: the radio device is in ON or OFF mode and it is supplied with power (VCC is applied).
- RTC back-up mode: VCC is disconnected and the RTC is maintained by a separate backup power supply connected to the VRTC input (see Figure 5.13 below).

Backup power is provided by a capacitor, golden-capacitor or battery in your application and must be connected to the VRTC pin. During RTC normal operation, the back up source will be charged.

In back-up mode, the back-up source must provide enough power for RTC operation. Refer to the table for the amount of current required.

The following table shows voltage characteristics for both modes.

Parameter	*Min.*	*Typ.*	*Max.*	*Units*
Supply Voltage RTC (normal mode - charging the capacitor)	1.6	1.8	2.0	V
Supply Voltage RTC (back-up mode - Capacitor provides the current)	1.0	1.8	2.0	V
Current drawn		5.0	10.0	µA

If the voltage drops below 1.0 V in back-up mode, the RTC will stop working. The following diagram shows the RTC connections.

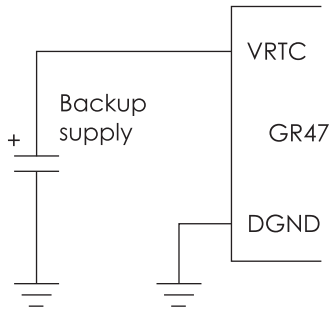


Figure 5.13 RTC connections

6 Antenna Connector

The radio device's antenna connector allows transmission of the radio frequency (RF) signals from the radio device to an external customer-supplied antenna. The connector is a micro-miniature coaxial MMCX surface mounted component. A number of suitable MMCX type, mating plugs are available from the following manufacturers;

- Amphenol;
- Suhner;
- IMS Connector Systems.

The nominal impedance of the antenna interface is 50Ω.

7 Keyboard Interface

To increase I/O capabilities, the radio device optimises the I/O by multiplexing or sharing different features on single pins. The I/O has been extended to allow simple interfacing of a matrix keypad.

7.1 IO#/KEYROW#

When configured for keypad operation the software will configure the digital I/O pins as input or high impedance tri-state. In this state, the keypad matrix row can be read from the KEYROW# inputs. These pins have a 100kΩ pull-up to 2.75V and the rows are considered activated when the voltage is pulled low by the external keypad switches.

7.2 KEYCOL#

The keypad matrix column drivers share functionality with the RS232 hardware flow control signals.

In addition to the keypad column outputs it is possible to use a direct ground connection as an additional column driver, which is interpreted as column zero.

Simply connect one keypad column directly to ground. When a key in this column is depressed KEYROW# is activated.

Thus it is possible to create a variety of keypad matrix sizes from single column to five columns wide.

Finally, a standard keypad matrix directly connects the rows to the columns whenever a key is depressed. In order to avoid short circuits if multiple keys are pressed simultaneously, the column drivers must be open-collector. This must be achieved with external transistors as the logic drive from the radio device is rail-to-rail. Suitable transistors for this interface are of the type with built in bias resistors between base and emitter.

The method of connection is shown below.

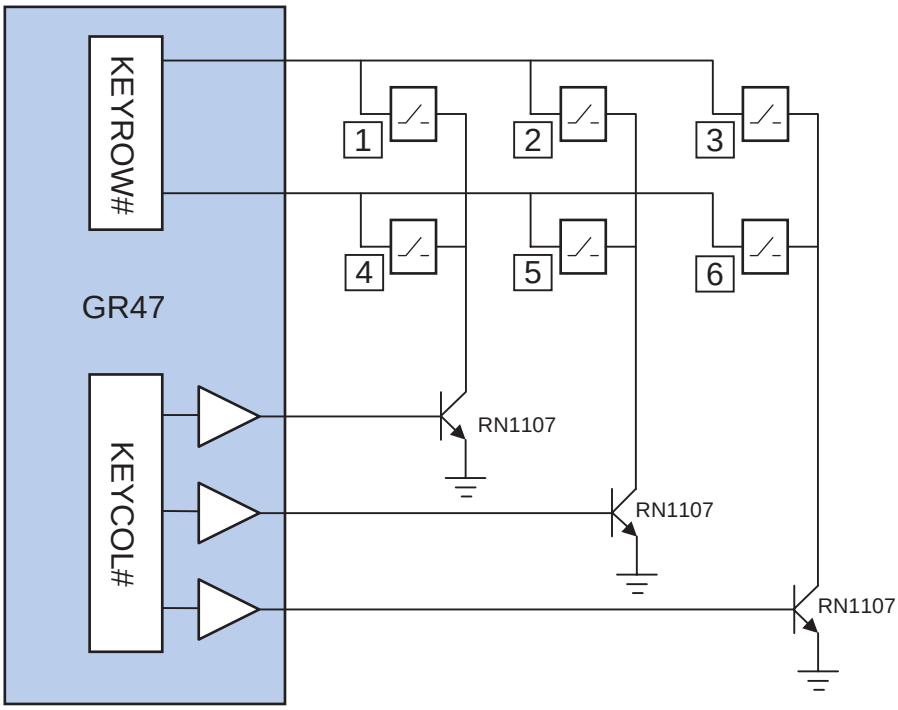


Figure 7.1 Keyboard matrix connections

Note! This matrix pattern may be repeated up to 5 columns and 4 rows (one column will use a ground connection as a virtual column driver).

Examples of suitable transistors are:

Brand	*Part Number*
Toshiba	RN1107 (as shown)
On SEMI	DTC114YET1
Philips	PDTC114YE
ROHM	DTC114YETL

8 Hints for Integrating the Radio Device

This chapter gives you advice and helpful hints on how to integrate the radio device into your application from a hardware perspective.

Please read and consider the information under the following headings before starting your integration work:

- Safety advice and precautions.
- Installation of the radio device.
- Antenna.

8.1 Safety Advice and Precautions

8.1.1 General

- Always ensure that use of the radio device is permitted. The radio device may present a hazard if used in proximity to personal medical electronic devices. As a rule, the radio device must not be used in hospitals, airports or planes.
- You are responsible for observing your country's safety standards, and where applicable the relevant wiring rules.
- Never use the radio device at a gas station, refuelling point, blasting area or in any other environment where explosives may be present.
- Operating the radio device close to other electronic devices, such as antennas, television sets, and radios may cause electromagnetic interference.
- Never try to dismantle the radio device yourself. There are no components inside the radio device that can be serviced by the user. If you attempt to dismantle the radio device, you may invalidate the warranty.
- To protect the power supply cables and meet the fire safety requirements, it is recommended that the electrical circuits are supplied with a power regulator. The power regulator should be placed as close to the terminals of the power supply as possible.
- Do not connect any incompatible component or product to the radio device.

Note! Sony Ericsson does not warrant against defects, non-conformities or deviations caused thereby.

- The connection/disconnection method for the development board is by means of the DC power jack. For this reason, the mains supply should be situated close to the development board and be easily accessible.

8.1.2 SIM Card

- Before handling the SIM card in your application, ensure that you are not charged with static electricity. Use proper precautions to avoid electrostatic discharges. The radio device must be switched off before the SIM card is installed in your application.
- When the SIM card hatch is opened, the SIM card connectors lie exposed under the SIM card holder. CAUTION: Do not touch these connectors! If you do, you may release an electrical discharge that could damage the radio device or the SIM card.
- When designing your application, the SIM card's accessibility should be taken into account. We always recommend that you have the SIM card protected by a PIN code. This will ensure that the SIM card cannot be used by an unauthorized person.

8.1.3 Antenna

- If the antenna is to be mounted outside, consider the risk of lightning. Follow the instructions provided by the antenna manufacturer.
- Never connect more than one radio device to a single antenna. The radio device can be damaged by radio frequency energy from the transmitter of another radio device.
- Like any mobile station, the antenna of the radio device emits radio frequency energy. To avoid EMI (electromagnetic interference), you must determine whether the application itself, or equipment in the application's proximity, needs further protection against radio emission and the disturbances it might cause. Protection is secured either by shielding the surrounding electronics or by moving the antenna away from the electronics and the external signals cable.
- The radio device and antenna may be damaged if either come into contact with ground potentials other than the one in your application. Beware, ground potential are not always what they appear to be.

- In the final application, the antenna must be positioned more than 20 cm away from human bodies. When this rule cannot be applied, the application designer is responsible for providing the SAR measurement test report and declaration.
- Even if SAR measurements are not required, it is considered good practice to insert a warning in any manual produced, indicating it is a radio product and that care should be taken.

8.2 Installation of the Radio Device

8.2.1 Where to Install the Radio Device

There are several conditions which need to be taken into consideration when designing your application as they might affect the radio device and its function. They are:

Environmental Conditions

The radio device must be installed so that the environmental conditions stated in the Technical Data chapter, such as temperature, humidity and vibration are satisfied. Additionally, the electrical specifications in the Technical Data section must not be exceeded.

Signal Strength

The radio device has to be placed in a way that ensures sufficient signal strength. To improve signal strength, the antenna can be moved to another position. Signal strength may depend on how close the radio device is to a radio base station. You must ensure that the location at which you intend to use the radio device, is within the network coverage area.

Degradation in signal strength can be the result of a disturbance from another source, for example an electronic device in the immediate vicinity. More information about possible communication disturbances can be found in section 8.3.5 page 61.

When an application is completed, you can verify signal strength by issuing the AT command AT+CSQ. See the AT Commands Manual for further details.

Note! Before installing the radio device, use an ordinary mobile telephone to check a possible location for it. In determining the location for the radio device and antenna, you should consider signal strength as well as cable length

Connection of Components to Radio Device

The integrator is responsible for the final integrated system. Incorrectly designed or installed, external components may cause radiation limits to be exceeded. For instance, improperly made connections or improperly installed antennas can disturb the network and lead to malfunctions in the radio device or equipment.

Network and Subscription

- Before your application is used, you must ensure that your chosen network provides the necessary telecommunication services. Contact your service provider to obtain the necessary information.
- If you intend to use SMS in the application, ensure this is included in your (voice) subscription.
- Consider the choice of the supplementary services described in section 2.3.2 Short Message Service, page 11.

8.2.2 How to Install the Radio Device

Power Supply

- Use a high-quality power supply cable with low resistance. This ensures that the voltages at the connector pins are within the allowed range, even during the maximum peak current. An electrolytic capacitor should be placed close to the power supply pins of the radio device to supply the peak currents during burst transmission. See 5.4 VCC - Regulated Power Supply Input.
- See section 5.2.1 General Protection Requirements, page 25.

Grounds

A ground connection is provided at the mounting hole next to the RF connector on the radio device (see figure 5.1, page 21). Connect this ground point to the DGND pins of the radio device by the shortest, low-impedance path possible. The purpose of this connection is to allow any ESD picked up by the antenna to bypass the radio device's internal ground path.

Note! It is recommended that you use a cable with a maximum resistance of 5 mΩ for the ground connection.

Note! AGND and DGND are connected at a single point inside the radio device. They must *not* be joined together in your application.

Audio

Use a coupling capacitor in ATMS line if the application does not use the radio device's bias voltage. See also Figure 5.5 Microphone connections to the radio device, page 33.

Software Upgrade

To upgrade the software, the system connector must be accessible in your application. The pins SERVICE, TD2, RD2 and the power signals are used for this purpose. Please contact customer support for more details.

8.3 Antenna

8.3.1 General

The antenna is the component in your system that maintains the radio link between the network and the radio device. Since the antenna transmits and receives electromagnetic energy, its efficient function will depend on.

- the type of antenna (for example, circular or directional).
- the placement of the antenna.
- communication disturbances in the vicinity in which the antenna operates.

In the sections below, issues concerning antenna type, antenna placement, antenna cable, and possible communication disturbances are addressed.

In any event, you should contact your local antenna manufacturer for additional information concerning antenna type, cables, connectors, antenna placement, and the surrounding area. You should also determine whether the antenna needs to be grounded or not. Your local antenna manufacturer might be able to design a special antenna suitable for your the application.

8.3.2 Antenna Type

Make sure that you choose the right type of antenna for the radio device. Consider the following requirements:

- the antenna must be designed for the dual frequency bands in use:

E-GSM900/GSM1800 for the GR47 and
GSM 850/GSM1900 for the GR48.

- the impedance of the antenna and antenna cable must be 50Ω.
- the antenna output-power handling must be a minimum of 2W.
- the VSWR value should be less than 3:1 to avoid damage to the radio device.

8.3.3 Antenna Placement

The antenna should be placed away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas, operating in a similar radio frequency band, is at least 50cm.

If signal strength is weak, it is useful to face a directional antenna at the closest radio base station. This can increase the strength of the signal received by the radio device.

The radio device's peak output power can reach 2W. RF field strength varies with antenna type and distance. At 10cm from the antenna the field strength may be up to 70V/m and at 1m it will have reduced to 7V/m.

In general, CE-marked products for residential and commercial areas, and light industry can withstand a minimum of 3V/m.

8.3.4 The Antenna Cable

Use 50Ω impedance low-loss cable and high-quality 50Ω impedance connectors (frequency range up to 2GHz) to avoid RF losses. Ensure that the antenna cable is as short as possible.

The Voltage Standing-Wave Ratio (VSWR) may depend on the effectiveness of the antenna, cable and connectors. In addition, if you use an adapter between the antenna cable and the antenna connector, it is crucial that the antenna cable is a high-quality, low-loss cable.

Minimize the use of extension cables, connectors and adapters. Each additional cable, connector or adapter causes a loss of signal power.

8.3.5 Possible Communication Disturbances

Possible communication disturbances include the following:

- **Noise** can be caused by electronic devices and radio transmitters.

- **Path-loss** occurs as the strength of the received signal steadily decreases in proportion to the distance from the transmitter.
- **Shadowing** is a form of environmental attenuation of radio signals caused by hills, buildings, trees or even vehicles. This can be a particular problem inside buildings, especially if the walls are thick and reinforced.
- **Multi-path fading** is a sudden decrease or increase in the signal strength. This is the result of interference caused when direct and reflected signals reach the antenna simultaneously. Surfaces such as buildings, streets, vehicles, etc., can reflect signals.
- **Hand-over** occurs as you move from one cell to another in the GSM network. Your mobile application call is transferred from one cell to the next. Hand-over can briefly interfere with communication and may cause a delay, or at worst, a disruption.

9 Embedded Applications

The radio device has the capability to store and run customer written code in the form of a script during the processor's idle time, through the use of an on board interpreter.

9.1 Features

Main features of embedded applications are as follows.

- C based scripting language (Sony Ericsson specific);
- Over the air upgrade of scripts (NOT GSM software);
- Library of intrinsic functions;
- 2 scripts can be stored in the memory at any time but only 1 can be active.

9.2 Implementation

The radio device has up to 44k of space available for storage of two scripts in the scripting language. Structures included in this language are:

- If - then - else statements
- While loops
- For loops

All hardware interfaces that are normally available to the radio device through the AT commands are available to the embedded application. Further drivers have been written such as M bus, keypad, SPI and I^2C for use by the embedded application (EA) through the use of the I/O pins.

9.2.1 Limitations

Since the radio device is processing the script using its own memory, limitations are placed onto the scripts that are run.

- A direct comparison cannot be made to a fully compiled C program in terms of size but a gauge of script size is that if each line were 128 characters long in the script then the script could be 350 lines long.
- Processing power is something that needs to be considered as the script is run as a low priority process within the software. However, controller mode stops GSM operation and provides all the processing power for the script to be run. See the M2*m*power Application Guide for more details.
- Code cannot be ported directly from an existing application and loaded directly onto the radio device. It must be re

written in the Sony Ericsson Mobile script language so that the radio device interpreter can function correctly.

9.2.2 M2*m*power IDE (Integrated Development Environment)

The IDE is a Windows based package which allows the user to write, simulate, debug and download the application into a radio device with the embedded application (EA) software. The standard version is designed to run on Windows XP and 2000, other versions are available for 98 if required.

The M2*m*power Application Guide is available for implementing applications using the developer's kit and the embedded application (EA) functionality.

This is a required package to be able to implement an embedded application (EA).

More detailed documentation is available, for this and further information please contact Sony Ericsson Mobile Communications customer support.

10TCP/IP Stack

An on board IP/TCP/UDP stack has been integrated into the software negating the need for the customer to implement one in their own code base.

The TCP/IP stack is accessible via both AT commands and the embedded application software in the GR47.

10.1 Implementation

The following types of commands allow various functions:

- Open/closing IP connection - Negotiates/closes a dynamic IP address with the web server.
- Send/Receive TCP packets - Performs all TCP operations to send and receive packets.
- Send/Receive UDP packets - Performs all UDP operations to send and receive packets.
- Resolve URL to an IP address - Similar to nslookup command in DOS
- Server/listen mode - This allows the unit to negotiate an IP address for itself and then listen for incoming traffic.

The implementation effectively provides a transparent communication link from the application to an internet server over GPRS.

11 Technical Data

Mechanical Specifications

Maximum length	50 mm
Maximum width	33 mm
Maximum thickness	6.82 mm (excluding connector pins and top of antenna connector)
Weight	18.5 g

Power supply voltage, normal operation

Voltage	3.6 V nominal (3.4 V - 4.0 V)
Ripple	< 100 mV @ <200 kHz; < 20 mV @ > 200 kHz
Voltage must always stay within a normal operating range, ripple included	
Power consumption	Voice/CSD: < 250 mA (< 2 A peak)
	Data (GPRS 4+1); < 350 mA (< 2 A peak)
	Idle mode: < 5 mA
	Switched off: < 100 µA

Radio specifications

Frequency range	GR47: E-GSM 900 MHz and GSM 1800 MHz (dual band) GR48: GSM 850 MHz and GSM 1900 MHz (dual band)
Maximum RF output power	GR47: 900 MHz, Class 4, 2 W; 1800 MHz Class 1, 1 W GR48: 850 MHz, Class 4, 2W; 1900 MHz Class 1, 1 W
Antenna impedance	50 Ω

SIM card

3 V or 5 V	Support of external SIM card

Environmental specifications

Operating temperature range (full specification)	-10 °C to +55 °C
Operating temperature range (working)	-30 °C to +75 °C
Storage temperature range	-40 °C to +85 °C
Maximum relative humidity	95 % at +40 °C
Stationary vibration, sinusoidal	Displacement: 7.5 mm Acceleration amplitude: 20 m/s² and 40 m/s² Frequency range: 2-8 Hz, 8-200 Hz, 200-500 Hz
Stationary vibration, random	Acceleration spectral density (m²/s²): 0.96, 2.88, 0.96 Frequency range: 5-10 Hz, 10-200 Hz, 200-500 Hz, 60 min/axis
Non-stationary vibration, including shock	Shock response spectrum I, peak acceleration: 3 shocks in each axis and direction; 300 m/s², 11 ms Shock response spectrum II, peak acceleration: 3 shocks in each axis and direction; 1000 m/s², 6 ms
Bump	Acceleration: 250 m/s²
Free fall transportation	1.2 m
Rolling pitching transportation	Angle: ±35 degrees; period: 8 s
Static load	10 kPa
Low air pressure/high air pressure	70 kPa/106 kPa

Data Storage

SMS storage capacity	40 in ME In addition, the unit can handle as many SMS as the SIM can store
Phone book capacity	100

12Declaration of Conformity

Declaration of Conformity

We, Sony Ericsson Mobile Communications AB of
Nya Vattentornet
S- 221 88 Lund, Sweden

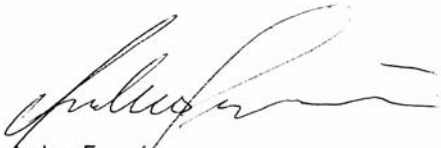
declare under our sole responsibility that our product

Sony Ericsson type 6100511- BV

and in combination with our accessories, to which this declaration relates is in conformity with the appropriate standards 3GPP TS 51.010-1, EN 301489-7 and EN 60950, following the provisions of, Radio Equipment and Telecommunication Terminal Equipment directive 99/5/EC with requirements covering EMC directive 89/336/EEC, and Low Voltage directive 73/23/EEC.

CE 0682

Basingstoke, May 2003
Place & date of issue



Anders Franzén
Corporate Vice President M2M Com

We fulfil the requirements of the R& TTE Directive (99/5/EC).

13 Introduction to the Universal Developer's Kit

The developer's kit is designed to get you started quickly. It contains all the hardware you will need to begin the development of an application. The only items you need to provide are; a radio device, a computer, a SIM card with a network subscription, and a knowledge of programming with AT commands.

Note! Before connecting up and using the developer's kit, we strongly recommend you read "Integrating the Radio Device", page 16 and all of this section. There are many switches, jumpers and connector options in the developer's kit. Knowledge of the functionality of the radio device is therefore essential before you start altering the hardware settings.

The main hardware of the UDK is an open board onto which you plug the radio device. Connectors, switches, jumpers and SIM card holder are provided to allow you to configure and access all the functions of the radio device.

13.1 Contents of the Kit

Please take the time to check the contents of your kit against the list shown below. If any of the items are missing contact your supplier immediately.

Description	*Manufacturer, Part #*	*Qty*
Power Supply, 12VDC	Astrodyne, SPU45-105 or Current Solutions, TR45A1211A02	1
Power Cord, US Plug	Allied, 626-3520	1
Power Cord, Euro Plug	Allied, 626-5206	1
Power Cord, UK Plug	Allied, 626-5200	1
Serial Cable, DB9MF	Assman, AK131-2	1
Hands-Free, 2.5mm Plug	Sony Ericsson, HBH0043-015430	1
Antenna, 900/1800 MHz	Panorama Antennas Ltd., TDE-3SP	1
Antenna, 800/1900 MHz	Panorama Antennas Ltd., TAP-3SP	1

Cable, 40-pin to 30-pin ribbon interface (DM-XX)	Sony Ericsson,2/1078 TVK 117 2403	1
Cable, 40-pin to 40-pin ribbon interface (CM-xx, GM-xx)	Sony Ericsson,3/1078 TVK 117 2403	1
Cable, MMCX rt. angle to MMCX straight	Sony Ericsson,1/1078 TVK 117 2403	1
UDK Developer's Board	ROA 117 2449	1
Nut, 2-56 Hex	Digi-Key, HD723-ND	2
Nut, 4-40 Hex	Digi-Key, HD724-ND	5
Rubber Feet	Allied, SJ-5303	6
Screw, 2-56, 1/2" Length	Digi-Key, H701-ND	2
Screws, 4-40, 5/16" Length	Digi-Key, H704-ND	18
Stand-offs, 4-40, .250" O.D., 3/4" Length	Digi-Key, 3481K-ND	2
Stand-offs, 4-40, .250" O.D., 5/8" Length	Digi-Key, 1839K-ND	4
Stand-offs, 2-56, .156" O.D., 1/4" Length	Digi-Key, 1801BK-ND	2
Washer, 2-56 Lock Inside Tooth	Digi-Key, H728-ND	2
Washer, 4-40 Lock Inside Tooth	Digi-Key, H729-ND	12
Aluminum Heat-Sink	Sony Ericsson, SXA 1341627	1
Thermal Pad	Comrades, 69-11-23587-T725	1
Documentation CD	Sony Ericsson	1

Table 1: Universal Developer's Kit Content List

13.2 Assembling the Developer's Board

The developer's board has been designed to work with several families of modules. Therefore you will need to assemble the mounting hardware based on the particular version of the module you are using. There are four different assemblies: the GM-41, the DM-xx family, the CM-4x family which requires a heat sink for 3W usage, and the smaller Gx-47/48.

13.3 Mounting a GX-47/48

This assembly will require (included in kit):

Description	*Manufacturer, Part #*	*Qty*
2-56, .156" O.D., 1/4" Length Standoffs	Digi-Key 1801BK-ND	2
2-56 x 1/2" Phillips Panhead Stainless Steel Machine Screw	Digi-Key H701-ND	2
2-56 Lock Washer, Inside Tooth, Stainless Steel (Use on bottom only)	Digi-Key H728-ND	2
2-56 Hex Nut	Digi-Key HD723-ND	1

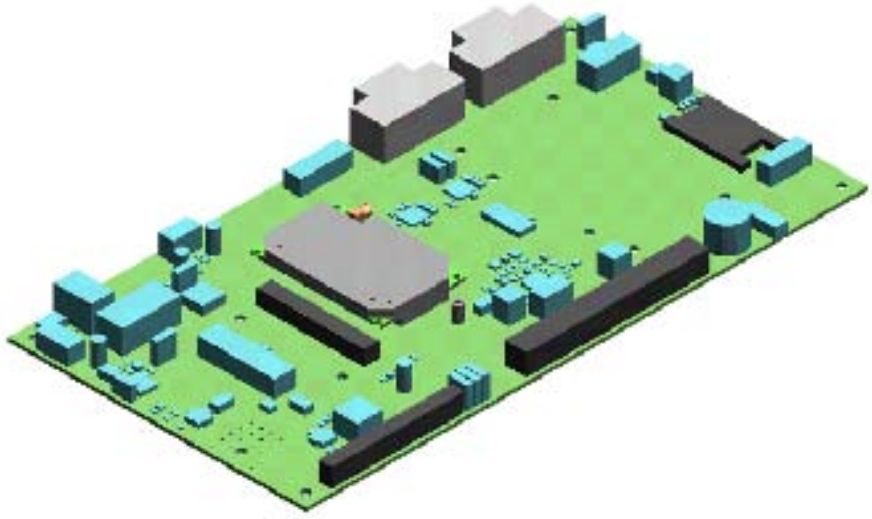


Figure 13.1 Exploded View of Developer's Board with GX-47/48

13.4 Assembly instructions:

- Use 1/2" screw with lock washer through the bottom of board to attach each 1/4" long standoff.
- Plug the module into the 60-pin connector X602.
- Attach module to standoff using a single 2-56 nut.
- Attach RF cable from module to J402. Make RF connections at J401 (SMA connector)

Note! Components under shield cans are sensitive to ESD and should be handled with appropriate measures.

13.5 System Requirements

The system requirements are:

- Personal Computer (PC) or unit compatible for RS232 communications.
- An unused serial port (COM1…. COM4) for communication between the developer's board and the PC.
- A second serial port may also be required for additional functionality.
- A terminal program such as HyperTerminal, Kermit, Procomm, etc…

13.6 GX-47/48 Family; Connection

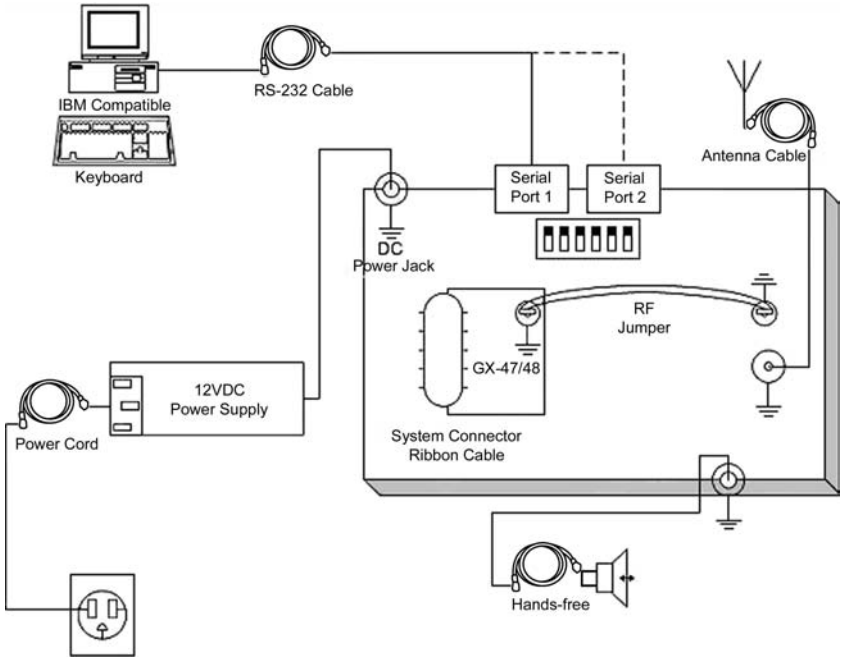


Figure 13.2 GX-47/48 Connection Diagram

- Connect serial cable from UDK board port 1 to an available serial port on the PC.
- The DC power supply provides the necessary 12VDC.
- Connect the power cable to the power supply and the AC outlet; select the appropriate line cord dependant on your location.
- Connect the output of the power supply to the power jack on the UDK board.
- Attach the provided antenna cable to the SMA antenna jack on the UDK board or directly to the primary RF output port of the module.

- For voice calls plug-in the provided Hands-free Speaker/Microphone.

14 Using the Universal Developer's Kit

This section details the specific developer's board settings for the GM/GR 47/48 family. It is important that you verify these settings before powering up the developer's board and module.

The following configurations should be considered the baseline whenever attempting to resolve issues with the board or module. Note that HW flow control is turned on.

Caution! Ensure the Rotary Switch has been set to 4 prior to powering on the Developer's Board. Failure to do so may result in damage to the module.

14.1 Gx-47/48 Setup

Switch Settings:

Rotary Switch Setting (SW104)	*Audio Switch S201*	*Audio Switch S202*	*Flash Switch S101*
4	Bypass	Bypass	DCD

Table 2: Baseline Switch Settings for Gx-47/48

Jumper Settings:

X100 (Supply Source)	*X101 (VDIG source select)*	*X102 (Flash)*	*X400 (SIM)*	*X501 (TD)*	*X502 (RD)*	*X503 (Buzzer)*	*TP101 (Test Point)*
Internal	1-2	Normal	Installed	Sec Port	Sec Port	Installed	Installed

Table 3: Baseline Jumper Settings for Gx-47/48

X603 (PCM)	*X601 (RTC)*	*X401 (TO_IN)*	*X402 (DTR_PWR_ON*	*X403 (I^2C Address)*	*X406 (I^2C Data)*	*X407 (I^2C Clk)*
Internal	Installed	Installed	Installed	Uninstalled	Installed	Installed

Table 4: Baseline Jumper Settings for Gx-47/48

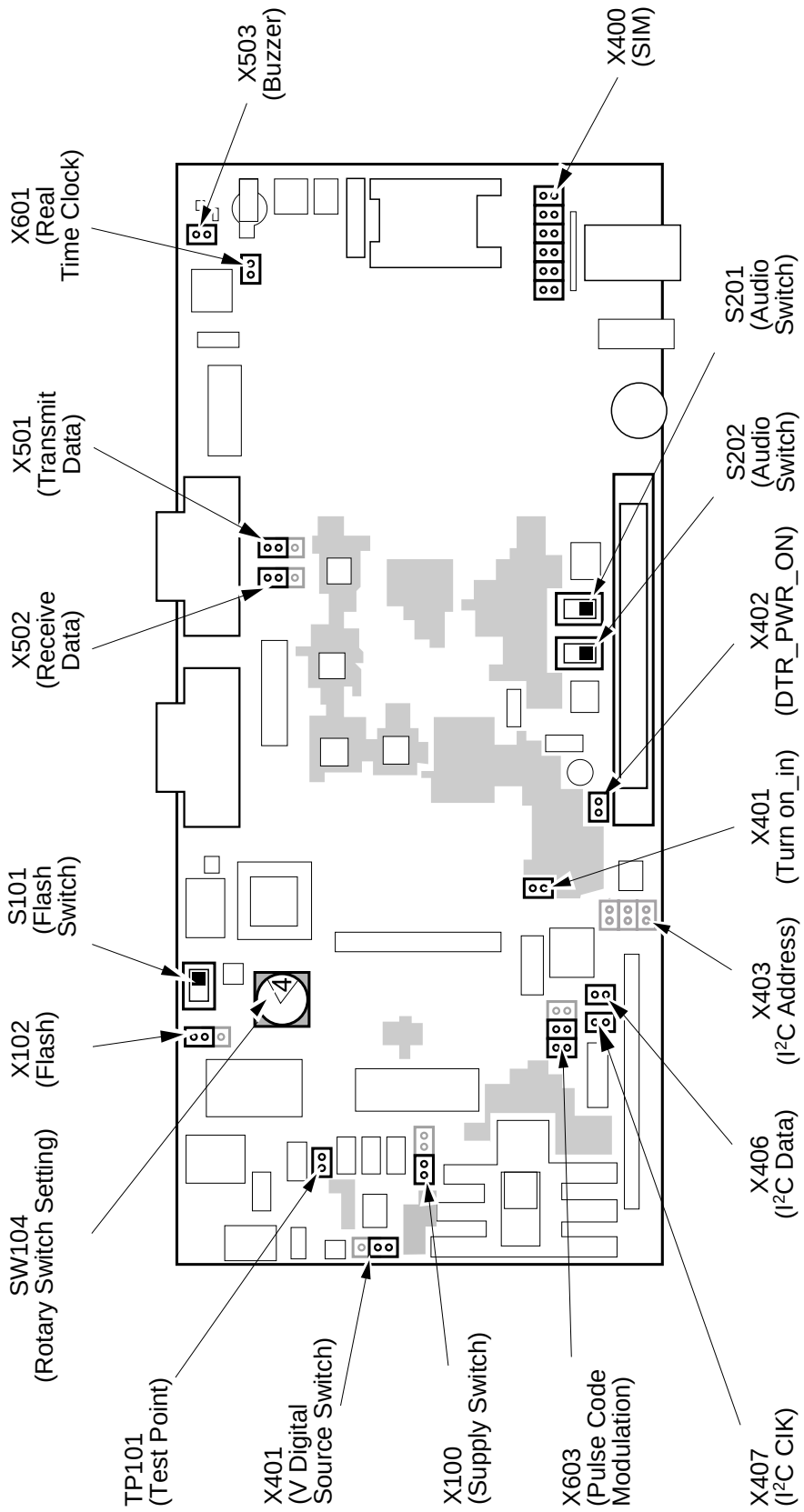


Figure 14.1 Switch and Jumper Settings

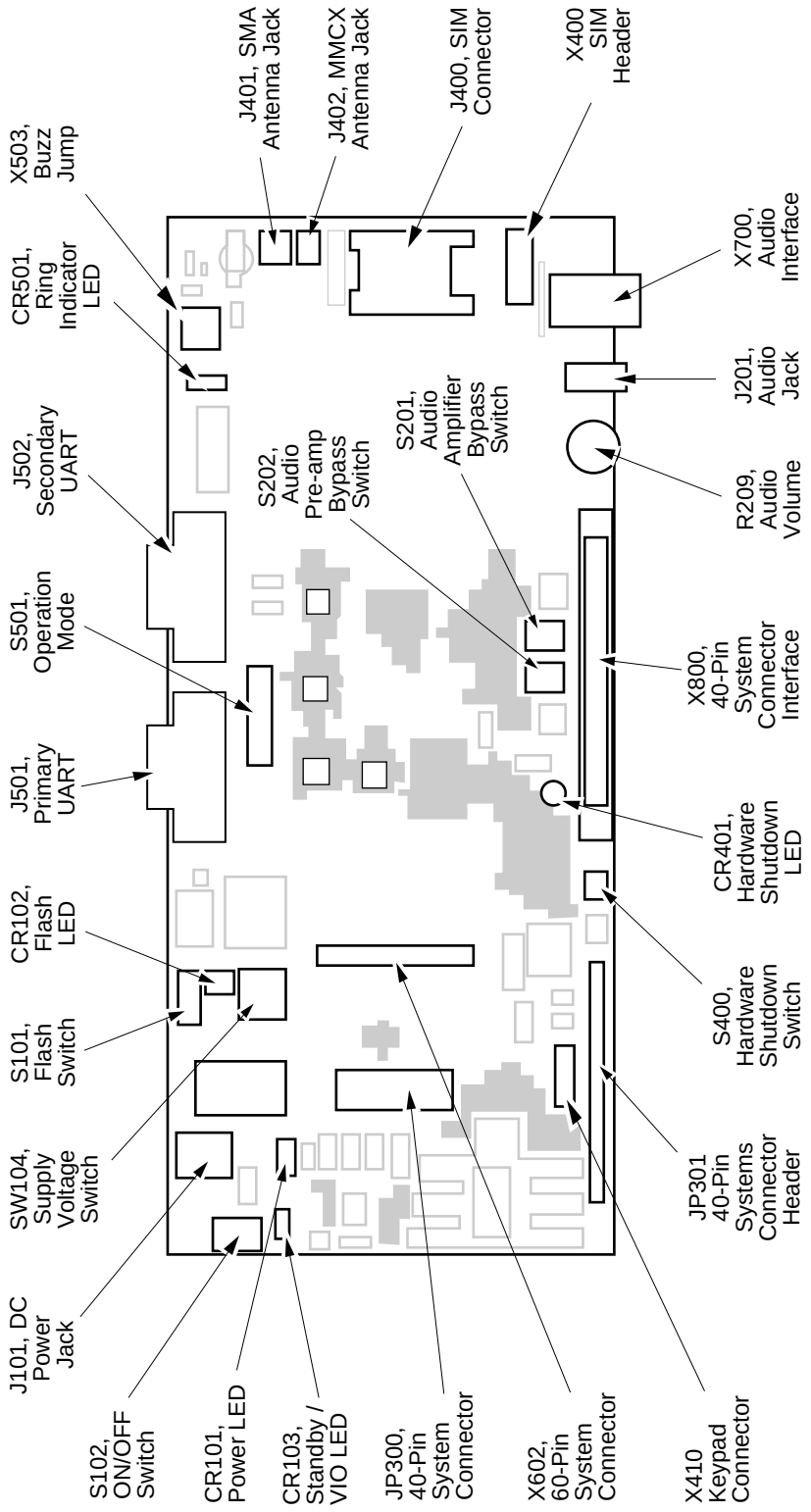


Figure 14.2 Switches, Indicators and Connectors

Operation Mode Settings:

Switch Position (S501)	*Function*	*ON/OFF*
Position 1	DTMS	ON
Position 2	CTS	ON
Position 3	DTR	ON
Position 4	DFMS	ON
Position 5	RTS	ON
Position 6	DSR	ON
Position 7	WAKE	ON

Table 5: Baseline Dip Settings for Gx-47/48

14.2 Operation Mode

Serial communication between the target module and the RS-232 level shifters is easily enabled / disabled via dip switches (S501). This allows testing of flow control (HW or None). This feature also allows the connection of your application's serial interface to the module while providing other connections, such as power, through the developer's board.

Switch	*Signal*	*ON*	*OFF*
Position 1	DTMS	Normal Operation	If External application is directly connected to System Connector Header
Position 2	CTS	HW Flow Control enable	If External application is directly connected to System Connector Header
Position 3	DTR	Normal Operation	If External application is directly connected to System Connector Header
Position 4	DFMS	Normal Operation	If External application is directly connected to System Connector Header
Position 5	RTS	HW Flow Control enable	If External application is directly connected to System Connector Header
Position 6	DSR	Normal Operation	If External application is directly connected to System Connector Header
Position 7	WAKE	Signal is grounded (Logic Low)	Signal is floating (Logic High)

Table 6: Description of Operation Mode Switch Settings

When switches 1 through 6 are in the OFF position, they are disconnected from the level shifters on the developer's board.

Hence the module determines the state of the signal at the System Connector Header. Refer to the appropriate Integrator's Manual for a description of the signals.

14.3 Serial interface

The external host communicates with the module/radio device through J501, which is a standard RS-232 9-pin interface (see below). The straight-through serial cable provided connects from J501 (DB-9 Female) to the serial port of a PC (DB-9 or DB-25 Female).

Pin	*RS-232*	*Description*
1	DCD	Data Carrier Detect
2	TXD	Transmission Data
3	RXD	Receiver Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

Table 7: RS-232 DB9 Pin-out

The primary connector, J501, routes all the signals to the module interface, while level shifting the appropriate ones. The secondary connector, J502, does not route all of the signals to the module. The following table details the signal routing from J502.

Pin	*RS-232*	*Routing*
1	DCD	Not Connected
2	TXD	to X502, Routes to CFMS (System Connector Pin 39) or TD3
3	RXD	to X501, Routes to CTMS (System Connector Pin 37) or RD3
4	DTR	Not Connected
5	GND	Ground
6	DSR	Not Connected
7	RTS	to J502 Pin 8 (CTS) through a 0 Ohm Resistor (R535)
8	CTS	to J502 Pin 7 (RTS) through a 0 Ohm Resistor (R535) and N502 Pin 17 through a 0 Ohm Resistor (R536)
9	RI	Not Connected

Table 8: RS-232 DB9 J502 Routing

Hardware Flow Control Mechanism is provided via the signals CTS, DTR and RTS. Flow control is used for CSD applications.

To activate or deactivate the Flow Control mechanism, switch S501 must be set as presented in Table 7 and Table 8 respectively.

Switch Position	*Function*	*DM-xx*	*CM-4x*	*GM-41*	*GM/GR 47/48*
Position 1	DTMS	ON	ON	ON	ON
Position 2	CTS	ON	ON	ON	ON
Position 3	DTR	ON	ON	ON	ON
Position 4	DFMS	ON	ON	ON	ON
Position 5	RTS	ON	ON	ON	ON
Position 6	DSR	ON	ON	ON	ON
Position 7	Module_Pwr_En_B		ON	ON	ON
	WAKE	OFF			

Table 9: S501 Settings to enable HW Flow Control

Switch Position	*Function*	*DM-xx*	*CM-4x*	*GM-41*	*GM/GR 47/48*
Position 1	DTMS	ON	ON	ON	ON
Position 2	CTS	OFF	OFF	OFF	OFF
Position 3	DTR	ON	ON	ON	ON
Position 4	DFMS	ON	ON	ON	ON
Position 5	RTS	OFF	OFF	OFF	OFF
Position 6	DSR	ON	ON	ON	ON
Position 7	Module_Pwr_En_B		ON	ON	ON
	WAKE	OFF			

Table 10: S501 Settings to disable HW Flow Control

If you intend to use the serial interface using the header connector (JP 301) provided on the developer's board, notice that appropriate CMOS voltage levels as defined by VDIG in §3.3 Power Interface shall be connected to the appropriate pins as follows:

Pin	*Signal*	*Description*	*Direction*
23	DCD	Data Carrier Detect	O
25	CTS	Clear To Send	O
26	DTR	Data Terminal Ready	I
27	TD	Serial Data To Module (DTMS)	I
28	RTS	Request To Send	I
30	RD	Serial Data From Module (DFMS)	O

Table 11: Direction of Serial Data Signals

If this type of interface is to be used, positions 1, 3, and 5 of S501 must be set to OFF to prevent damage to the RS-232 transceivers.

14.4 Engine Application Port - 40-Pin Connector (X600)

The system connector header is used when the application requires direct access to any particular pin available in the system interface of the module (i.e., digital audio pins). This applies to the Gx-47/48 modules.

Note! Special care shall be taken when using the header connector in order to prevent damage to the RS-232 transceivers. The following table shows how to set the switch S501 when using the Application Port.

Switch	*Position Function*	*ON/OFF*
Position 1	DTMS	OFF
Position 2	CTS	OFF
Position 3	DTR	OFF
Position 4	DFMS	OFF
Position 5	RTS	OFF
Position 6		OFF

Table 12: Switch Settings for S501 when using the Application Port

Pin	*Signal*	*Description*
1	VCC	Regulated supply voltage
2	VCC	Regulated supply voltage
3	DGND	Chassis Ground
4	DGND	Chassis Ground
5	ON/OFF	ON/OFF control of the radio device
6	TO_IN	Turn on in
7	HR_IN	Hardware Reset in
8	X606_1	Connection to Header X606 Pin 1
9	IO_1	General Purpose Binary Input / Output # 1
10	IO_2	General Purpose Binary Input / Output # 2
11	IO_3	General Purpose Binary Input / Output # 3
12	IO_4	General Purpose Binary Input / Output # 4
13	VIO	Input/Output Voltage Reference
14	DGND	Chassis Ground
15	IO_5	General Purpose Binary Input / Output # 5

16	ADC1	Output for A/D Converter #1
17	ADC2	Output for A/D Converter #2
18	ADC3	Output for A/D Converter #3
19	DAC	Input for D/A Converter
20	DGND	Chassis Ground
21	IO_6	General Purpose Binary Input / Output # 6
22	TX_ON	Transmit on
23	SDA	I^2C bus, data line
24	SCL	I^2C bus, clock line
25	DGND	Chassis Ground
26	X606_2	Connection to Header X606 Pin 2
27	DFMS	Data from Mobile Station
28	DTMS_C	Data to Mobile Station
29	RTS_M	Request to Send
30	CTS_M	Clear to Send
31	DSR_M	Data Set Ready
32	RI_M	Ring Indicator
33	DCD_SW	Data Carrier Detect
34	DTR_M	Data Terminal Ready
35	CTMS	Secondary Data to Mobile Station
36	CFMS	Secondary Data from Mobile Station
37	TD3	Transmit Data
38	RD3	Receive Data
39	X606_3	Connection to Header X606 Pin 3
40	X606_4	Connection to Header X606 Pin 4

Table 13: Pin-out of 40-Pin Application Port (X600)

14.5 RF Interface

A MMCX connector, J402, is provided on the Developer's board and routed to a SMA connector, J401. This allows a standard cellular antenna with SMA connector to be used if the module has a non-SMA connector mounted on it. An MMCX to MMCX RF Jumper is provided to connect from the module to J402.

14.6 Audio Interface

Analog audio is routed to/from the Developer Kit in two ways and is controlled by switches S201 and S202:

1 Via a 2.5mm stereo jack at J201 (S201 set to “Pre-Amp” and S202 is “ON”). Used with hands-free set.

2 Via ATMS and AFMS (S201 set to “Bypass” and S202 is “OFF”).

3 The Gx-47/48 platform does not require the external pre-amp. Set S201 to “Bypass” and S202 to “OFF”.

Analog audio is provided on pins 7 and 10 of the system connector header as presented below:

Pin	*Signal*	*Description*
7	AFMS	Audio Output From Module (referenced to AGND)
10	ATMS	Audio Input to Module (referenced to AGND)
9	AGND	Analog Reference

Digital audio is provided on pins 17, 18, 19 and 20 of the system connector header. The application must ensure providing the correct levels on the PCM signals according to the Digital Audio section of the appropriate Integrator's Manual. The PCM signals available in the system connector header are presented below:

Pin	*Signal*	*Description*
17	PCMCLK	PCM Clock Output from module.
18	PCMSYNC	PCM Frame Sync Output from module.
19	PCMULD	PCM Voice Input to module.
20	PCMDLD	PCM Voice Output from module.

14.7 Keypad Connector (X410)

A 10 pin connector is provided to connect directly to the Keypad options when they are selected by the AT command AT*E2IO.

Pin	*Signal*	*Description*
1	KEYCOL0	Keyboard column 1 (GND)
2	KEYROW1	Data Terminal Ready / Keyboard row 1 / General purpose
3	KEYCOL1	Data Carrier Detect / Keyboard column 1 / General purpose output 1
4	KEYROW2	General purpose input/output 1 / Keyboard row 2
5	KEYCOL2	Ring Indicator / Keyboard column 2 / General purpose output 2
6	KEYROW3	General purpose input/output 3 / Keyboard row 3
7	KEYCOL3	General purpose output 5 / Keyboard column 3 / Data Set Ready
8	KEYROW4	General purpose input/output 4 / Keyboard row 4
9	KEYCOL4	Clear To Send / Keyboard column 4 / General purpose output 4
10	N/C	Not connected

Table 14: Keyboard Connector X410

14.8 Flashing Firmware

The developer's board has the hardware circuitry to support firmware upgrading of several of the module families. Switch S101 when placed in the FLASH mode allows the module to re-flashed. Header X102 selects the Voltage used for Re-Flash

	DCD	*Flash*
S101	Normal Operation	FLASH Mode

	Normal (VDIG)	*FAST (12V)*
X102	1-2	2-3

14.9 Operation

Once the module has been mounted to the developer's board and all connections are made you are ready to power up the developer's board. Refer to Mounting a GX-47/48, page 71 for mounting information and a connection diagram.

Power On

To Power on the unit, ensure a 12VDC supply is connected to J101 and toggle the power switch S102. CR101 upper should illuminate. Press S400 and hold down for at least 0.5 seconds. CR103 upper should illuminate then about 4 seconds later CR103 lower will illuminate and a random character should appear in your terminal program (if connected to Serial port 1 and port settings are correct). Refer to GX-47/48 Family; Connection, page 72.

14.10 Flow Control

The developer's board has the ability to disable and enable the routing of HW flow control signals between the PC and the module. This is accomplished by setting S501 as per section 14.3.

Whenever communications difficulties arise with the module, disable HW flow control both on the developer's board and in your terminal program as a first step.

14.11 Power Down

When shutting down the developer's board and/or module it is important that the module is allowed to perform and orderly shutdown before power is removed. Do NOT simply pull the plug. Press S400 (the hardware shutdown button) and hold down for at least 1.5 seconds. Or send AT+CFUN=0. The radio device takes a few seconds to shut down properly. CR103 upper will stay illuminated until shutdown is complete.

GR47/GR48
AT Commands Manual

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1 Introduction to AT Commands

This manual lists detailed information on the function of the AT Command set that can be used with your GR47 or GR48.

Note! This manual refers to the GR47 and GR48 as radio devices. If there is a difference in the functionality of the radio devices the GR47 and GR48 information will be listed separately.

1.1 *Related Documentation*

This manual is supplied with an Integrator's Manual when you purchase a GR47 or the GR48. If you choose to use the M2*m*power support environment with your module you will also receive an Application Guide.

1.2 *Overview*

AT commands, issued from a computer in your application are used to control and implement the functions of the module.

Using AT commands, the following actions are possible:

- Control of DCE
- GPRS
- Call control
- Supplementary Service
- SIM application tool kit
- Control any embedded application in the device

The GR47 contains a large number of Ericsson-specific commands in addition to those implemented in accordance with the GSM and ITU-T recommendations. These commands are provided to enhance the functions of the module. The Ericsson-specific commands are identified by the asterisk that precedes the command (see the syntax description provided below).

Note! Only commands that are listed in the AT Commands Manual are supported unless otherwise stated. Other commands may be listed by the module but these are only included for historical or legacy reasons.

1.3 *Syntax Description*

This section provides a brief description of the syntax used for the GR47, AT command set. See the ITU-T recommendation V.25ter for additional information.

1.3.1 Conventions

In this manual, the following conventions are used to explain the AT commands.

<command>	The name of the command that is to be entered.
<parameter>	The parameter values that are defined for a certain command.
<CR>	The command line is terminated by the Carriage Return (or Enter key) or ATS3 command.
<LF>	Line feed character or ATS4 command.
< >	The term enclosed in angle brackets is a syntactical element. The brackets do not appear in the command line.
[ ]	Square brackets are used to indicate that a certain item is optional. For example, sub-parameters of a command or an optional part of a response. The brackets do not appear in the command line.
Value	The default values of the supported parameters are indicated by using bold text when presenting the value.

- Other characters, including '?', '□', parenthesis, etc., appear in commands and responses as written.
- The final result codes OK, ERROR, +CME ERROR: <err> and CMS ERROR:<err> (see sections 1.3.3 AT Response Syntax and 1.4 Error Codes) are not listed under "Possible Responses" for each AT command.
- OK and ERROR are listed if these are the only possible responses.

1.3.2 AT Command Syntax

The AT standard is a line-oriented command language. Each command is made up of the following three elements:

- the prefix;
- the body;
- the termination character.

The prefix consists of the letters “AT”, which are derived from the first two letters of the word attention. The body is made up of the **command,** the **parameter,** and if applicable the associated **values**.

Commands may be combined in the same command line. Spaces between the individual bodies are ignored.

Basic Syntax Command

The format of basic syntax commands is as follows:

AT<command>[=][<parameter>]<CR>

Example! ATL=0<CR> (sets the volume of the speaker)

Additional commands may follow a command on the same command line without any character being required for separation. For the command D parameters, see the description for the command in question.

A version of the basic syntax is:

AT<command><parameter>

Extended Syntax Command

- **AT+<command>= [<parameter>]**
- AT*<command>=[<parameter>]

Example! AT+CFUN=0<CR> (powers down the module)

If several values are included in the command, they are separated by commas. It is also possible to enter commands with no values.

Additional commands may follow an extended syntax command on the same command line if a semicolon (**;** IRA 3B) is inserted after the preceding extended command as a separator.

Read Command Syntax

The read command is used to check the current values of parameters. Type ‘?’, after the command line:

- AT+<command>?
- AT*<command>?
- AT<command>?

Example! AT+CSCS?<CR> (show current character set)

<CR>“IRA”<CR> (information *text* response)

<CR>OK<CR>*(final result code response)*

Test Command Syntax

The test command is used to test whether the command has been

implemented or to give information about the type of subparameters it

contains. Type '?', after the command line:

- AT+<command>=?
- AT*<command>=?

Example! AT+CPAS=?<CR> (*shows supported values for the response parameters*)

<CR>CPAS: (0, 3, 4, 129, 130, 131)<CR> *(supported values)*

<CR>OK<CR> *(final result code)*

If the indicated <parameter> is not recognized, the result code ERROR is issued.

Note! Possible responses are indicated both as <command>:(list of supported<parameter>) and (in most cases) the actual range of the parameter values.

1.3.3 AT Response Syntax

The default mode response shown below, is in text mode. See the command ATV for further details.

Possible formats for the result codes are:

- Basic format result code, such as OK. The Basic result code also has a numerical equivalent.
- Extended format result code, prefixed with a plus sign (+) or an asterisk (*):
  - **AT+<command>: <parameter >**
  - **AT*<command>: <parameter>**

where the <parameter> is the result code value, note that a single space character separates the colon character from the <parameter>. If several values are included in the result code, they are separated by commas. It is also possible that a result code has no value. The extended syntax result codes have no numerical equivalent. They are always issued in alphabetical form.

- Information text response may contain multiple lines separated by <CR>. The TE detects the end of informational text responses by looking for a final result code response, such as OK.

There are two types of result code responses as outlined below:

Final Result Code

A final result code indicates to the TE that execution of the command is completed and another command may be issued.

- If you type an implemented AT command, you should get the result code OK.
- If you type an AT command that is not implemented, or which had the wrong parameter or syntax, you will get an error result code. It is ERROR or, for example, +<**command**> ERROR followed by an error code.

Final result codes are:

Value	**General meaning**
OK	Command executed, no errors
ERROR	Invalid command or command line too long
NO DIALTONE	No dialling possible, wrong mode
BUSY	Remote station busy
NO ANSWER	Connection completion time-out
NO CARRIER	Link not established or disconnected

Unsolicited Result Code

Unsolicited result codes indicate the occurrence of an event not directly associated with a command being issued from the TE.

1.4 *Error Codes*

1.4.1 +CME ERROR (Mobile Equipment Error Code)

This final result code is similar to the regular ERROR result code. If +CME ERROR: <err> is the result code for any of the commands in a command line, none of the commands in the same command line will be executed (neither ERROR nor OK result code shall be returned as a result of a completed command line execution). The format of <err> can be either numerical or alphabetical, and is set with the +CMEE command.

The table below provides the numerical values for the parameter <err>.

<err>	*Description Syntax*
0	ME failure
1	No connection to ME

2	ME -adaptor link reserved
3	Operation not allowed
4	Operation not supported
5	PH-SIM PIN required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	Memory full
21	Invalid index
22	Not found
23	Memory failure
24	Text string too long
25	Invalid characters in text string
26	Dial string too long
27	Invalid characters in dial string
30	No network service
31	Network time-out
32	Network not allowed - emergency calls only
100	Unknown
101- 255	Reserved by ETS

1.4.2 +CMS ERROR (Message Service Failure Result Code)

This final result code indicates an error related to mobile equipment or to the network. The operation is similar to the ERROR result code. None of the following commands in the same command line will be executed. Neither ERROR nor OK result code will be returned. ERROR is returned normally when

an error is related to syntax or invalid parameters. Nevertheless, it always appears when a command fails.

The syntax is as follows:

+CMS ERROR: <err>

Values for the <err> parameter are described in the following table.

<err>	*Description*
0 - 127	GSM 04.11 Annex E-2 values
128 - 255	GSM 03.40 subclause 9.2.3.22 values
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	Operation not supported
304	Invalid PDU mode parameter
305	Invalid text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
316	SIM PUK required
317	SIM PIN2 required
318	SIM PUK2 required
320	Memory failure
321	Invalid memory index
322	Memory full
330	SMSC address unknown
331	No network service
332	Network time-out
340	No +CNMA acknowledgment expected
500	Unknown error
- 511	Other values in range 256 - 511 are reserved

512-	Manufacturer specific

1.5 *Examples on How to Use the AT Commands*

For many of the more complicated commands, examples are provided after the command's description. Always refer to the detailed description of the command in question to check valid parameter values, AT command syntax and Response syntax.

1.6 *SMS Text Mode*

SMS text mode allows users to send SMSs without having to understand how PDUs are constructed. This section describes how to carry out basic operations in text mode and explains the steps that need to be taken.

Basic transmission of SMS

A script which sets the module up is shown below:

AT+CSMP=17,167	Set text mode parameter
OK	
AT+CMGF=1 OK	Switch the module to text mode
AT+CMGS="07787154042"	Sending an SMS
> Test SMS➔	The text must be ended, as in PDU mode, with a control-Z character (ASCII 26)
+CMGS: 204	Confirmation that the SMS has been sent successfully

Note the following points:

1. Once the CSMP and CMGF commands have been carried out they will not need to be initialized for this session.

2. These parameters are saved in NVRAM using the &W command.

Notification of SMS

New message indications are similar to the PDU mode as shown below:

```
AT+CNMI=3,1
OK

+CMTI: “SM”,2

AT+CNMI=3,2
OK

+CMT: “+447747008670”,“Matt
L”,“02/11/19,09:58:42+00”,145,36,0,0,“+447785016005”
,145,8
Test sms
```

Reading messages

Reading messages is performed as in PDU mode.

```
AT+CMGR=2
+CMGR: “REC UNREAD”,“+447747008670”,“Matt
L”,“02/11/19,09:57:28+00”,145,36,0,0,“
+447785016005”,145,8
Test sms

OK
```

Listing messages

In PDU mode numbers are used as parameters. In text mode letters are used instead and these must be upper case as the module does not accept lower case commands. See the example below:

Example!

```
AT+CMGL=“ALL”
 +CMGL: 1,“REC READ”,“+447747008670”,“Matt
 L”,“02/10/21,10:07:23+04”,145,4
 Test
 +CMGL: 2,“REC READ”,“+447747008670”,“Matt
 L”,“02/11/19,09:57:28+00”,145,8
 Test sms
 +CMGL: 3,“REC UNREAD”,“+447747008670”,“Matt
 L”,“02/11/19,09:58:06+00”,145,8
 Test sms

 OK
```

1.7 *GPRS Communication*

To initiate a session with the network you need to setup a ‘data account’ on the module, using the AT+CGDCONT command. You need to specify the correct Access Point Name (APN), which you get from your service provider. The command below sets up the data account to access Vodafone’s internet server.

AT+CGDCONT=1,“IP”,“internet”

After this you need to use the ATD command to make a GPRS call. The example below dials into the network using account number 1 (the GR47 supports up to 10):

ATD*99***1#

If the module is able to connect to the APN it will return a CONNECT. At this point PPP/IP packets should be sent by the application, to negotiate an IP address. The easiest way of doing this whole thing is to create a windows dial up networking session with the dial string *99***1# after creating the data account on the module.

It is not possible to initiate a GPRS session from the network at present. The reason for this is that unless a PDP context has been setup it has not been assigned an IP address by the GGSN/DHCP server and as a result it cannot be addressed other than through its ME number (defeating the object of using IP). This is specified in GSM 7.60 or 3GPP 27.060.

More detailed notes on this are contained in the application notes which can be obtained from the extranet or from customer support.

1.7.1 On board TCP/IP stack

The TCP/IP stack on board the module is accessible via the AT commands, these commands are broken down in section 7, for details on how to use these please refer to the 'Using AT commands to control the on board TCP-IP stack with GR47/48', this is available through the extranet or from customer support, quote GR47/48 Application Note LZT 123 7631.

2 Call Control

2.1 *AT+CPIN PIN Control*

See 3.29, AT+CPIN PIN Control

2.2 *ATA Answer Incoming Call*

Description	*Command*	*Possible Responses*
Answer an incoming call	ATA	• CONNECT • CONNECT <text> • NO CARRIER • ERROR • OK

Answer and initiate connection to an incoming call.

<text>	*Description*
19200	Connected with data bit rate of 19200 bits/s (HSCSD)
9600	Connected with data bit rate of 9600 bits/s
4800	Connected with data bit rate of 4800 bits/s
2400	Connected with data bit rate of 2400 bits/s

2.3 *ATD Dial*

Description	*Command*	*Possible Responses*
• Originate a call and dial the ME number specified in the command as <dial_string> or • Do a network detect	ATD<dial_string>[;]	• CONNECT • CONNECT <text> • NO CARRIER • ERROR • NO DIAL TONE • BUSY • OK
Dial the ME number stored in the ME which is located by the index <I>	ATD>ME<I>[;]	• CONNECT • CONNECT <text> • NO CARRIER • ERROR • NO DIAL TONE • BUSY • OK
Dial the ME number stored in the SIM card which is located by the index <I>	ATD>SM<I>[;]	• CONNECT • CONNECT <text> • NO CARRIER • ERROR • NO DIAL TONE • BUSY • OK
Dial the ME number stored in the *Last dialled number* list on the SIM card, which is located by the index <I> The most recently dialled number is assumed to have <I>="1"	ATD>LD<I>[;]	• CONNECT • CONNECT <text> • NO CARRIER • ERROR • NO DIAL TONE • BUSY • OK
Redial the last ME number dialled. **Ericsson specific**	ATDL[;]	...

Description:

Used to initiate a ME connection, which may be data or voice (ME number terminated by semicolon). The ME number used to establish the connection will consist of digits and modifiers, or a stored number specification.

If the dial string is followed by a semicolon this informs the ME that the number is a voice rather than a data number.

If the dial string is omitted, and the semicolon included, the command instructs the ME to do a network detect. If the network is available OK is returned.

Abortability:

Aborting an ATD command is accomplished by the transmission from the DTE to the DCE of any character. A single character shall be sufficient to abort the command in progress; however, characters transmitted during the first 125 milliseconds after transmission of the termination character are ignored. This is to allow the DTE to append additional control characters such as line feed after the command line termination character.

<dial_string>	*Description*
"0 1 2 3 4 5 6 7 8 9 * # +"	Valid characters for origination
W	The W modifier is ignored but is included only for compatibility purposes
,	The comma modifier is ignored but is included only for compatibility purposes
T	The T modifier is ignored but is included only for compatibility purposes
P	The P modifier is ignored but is included only for compatibility purposes

<Final Result Code>	*Description*
CONNECT	If connection is successfully established, only valid for data connections
CONNECT <text>	If connection is successfully established, only valid for data connections
NO CARRIER	Unable to establish a connection or the connection attempt was aborted by the user
ERROR	An unexpected error occurred while trying to establish the connection
NO DIALTONE	The ME is being used for a voice call or is not within coverage of the network
BUSY	The ME number called is engaged, valid for data and voice connections
OK	Only valid for voice connections

<text>	*Description*
19200	Connected with data bit rate of 19200 bits/s (HSCSD)
9600	Connected with data bit rate of 9600 bits/s
4800	Connected with data bit rate of 4800 bits/s

2400	Connected with data bit rate of 2400 bits/s

Example! ATD07747008670;
OK

2.4 *ATH Hang up*

Description	*Command*	*Possible Responses*
Terminate the call	ATH	• ERROR • OK

Description:

Signals the MS to terminate an active call.

Note! This does not work for incoming calls, to hang these up the AT+CHUP command should be used

Note! If hanging up a call while a GPRS session is active the multiparty command should be used (AT+CHLD). If it is not then the module software will internally hang all calls up and the application not be able to return to the session.

2.5 *ATL Monitor Speaker Loudness*

Description	*Command*	*Possible Responses*
Request monitor speaker loudness	ATL[<value>]	• OK • ERROR
Show the current setting	ATL?	L: <value>
Show if the command is supported	ATL=?	L: (list of supported <values>s)

Description:

Included for compatibility. It is recommended to use the AT*E2EAMS command which provides comprehensive control of all the audio settings. The settings from AT*E2EAMS can be saved using AT*E2APR, but those from ATL cannot be saved. ATL can be used to modify the volume during a call, but any changes are lost at the end of the call.

<value>	*Description*
0	-14 dB (minimum speaker volume)
1	-10.5 dB

2	-7 dB
3	-3.5 dB
4	0 dB (nominal speaker volume)
5	3.5 dB
6	7 dB
7	10.5 dB
8	14 dB (maximum speaker volume)

2.6 *ATO Return to Online Data Mode*

Description	*Command*	*Possible Responses*
Return to on-line data mode	ATO[<value>]	• CONNECT • CONNECT <text> • NO CARRIER • ERROR

Description:

Switch to the on-line data mode from the on-line command mode during an active call. Returns ERROR when not in on-line command mode.

<value>	*Description*
0	Return to on-line data state from on-line command

2.7 *ATP Select Pulse Dialling*

Description	*Command*	*Possible Responses*
Select pulse dialling	ATP	OK
Show if the command is supported	ATP=?	OK

Description:

Command is ignored, and is implemented for compatibility only. It would normally cause the next D command to use pulses when dialling the number.

2.8 *ATT Select Tone Dialing*

Description	*Command*	*Possible Responses*
Select tone dialing	ATT	OK
Show if the command is supported	ATT=?	OK

Description:

Command is ignored, and is implemented for compatibility only. It would normally cause the next D command to use tones when dialling the number.

2.9 *ATX Call Progress Monitoring Control*

Description	*Command*	*Possible Responses*
Set call progress monitoring control	ATX=[<n>] or ATX[<n>]	• OK • ERROR
Show the current setting	ATX?	X: <n>
Show if the command is supported	ATX=?	X: (list of supported <n>s)

Description:

Defines if the dial-tone detection and busy-tone detection are to be used during a call set-up.

<n>	*Description*
0	*Body and dial tone detection off. No line speed reported on connection*
1	Body and dial tone detection off. Report line speed on connection
2	Busy detection on and dial tone detection off. Report line speed on connection
3	Busy detect off and dial tone on. Report line speed on connection
4	Busy detect and dial tone detection on. Report line speed on connection. **Default value**

Note! If there is no network available the <n> parameter will decide if “NO DIALTONE” or “NO CARRIER” will be returned. If the call recipient is busy, the <n> parameter will decide if “BUSY” or “NO CARRIER” will be returned.

2.10 *AT+CHUPHang up Call*

Description	*Command*	*Possible Responses*
Request hang-up	AT+CHUP	• OK • ERROR
Show if the commands is supported	AT+CHUP=?	• OK • ERROR

Description:

Causes the TA to hang-up the current call of the ME.

If no call is present, but an incoming call is notified, then the incoming call shall be rejected.

2.11 *AT+CMOD Call Mode*

Description	*Command*	*Possible Responses*
Request Call Mode	AT+CMOD=[<mode>]	• OK • ERROR
Show the current setting	AT+CMOD?	• +CMOD: <mode> • OK • ERROR
Show if the command is supported	AT+CMOD=?	• +CMOD: (list of supported <mode>s) • OK • ERROR

Description:

Selects the call mode of further dialing commands (D) or for next answering command (A). Mode can be either single or alternating. In this ETS, terms “alternating mode” and “alternating call” refer to all GSM bearer and teleservices that incorporate more than one basic service (voice, data, fax) within one call.

When single mode is selected the call originating and hang-up procedures are similar to procedures specified in ITU-T Recommendations V.25ter, T.31 and T.32. In GSM there can be voice followed by data (refer to GSM 02.02), alternating voice/data (refer to GSM 02.02) and alternating voice/fax calls (refer to GSM 02.03).

Test command returns values supported by the TA as a compound value.

Note! +CMOD is set to zero after a successfully completed alternating mode call. It is set to zero also after a failed answering. The power-up, factory (&F) and user resets (Z), also set the value to zero. This reduces the possibility that alternating mode calls are originated or answered accidentally.

<mode>	*Description*
0	Single mode. **Default value**. In order to avoid accidental originating or answering of alternating calls is <mode> set to single mode in following cases: - after a successfully completed alternating mode call; - after a unsuccessful answering; - after successfully execution of the commands &F and Z

2.12 *AT+CVHU Voice Hang-Up*

Description	*Command*	*Possible Responses*
Set Command	+CVHU=[<mode>]	• +CME ERROR: <err> • OK
Show the current setting	+CVHU?	• +CVHU: <mode> • +CME ERROR: <err>
Show if the command is supported	+CVHU=?	+CVHU: (list of supported <mode>s)

Description:

Selects whether ATH or “drop DTR” causes a voice connection to be disconnected or not. Voice connection also includes alternating mode calls that are currently in voice mode.

Note! When <mode>=2, this command must be viewed in conjunction with the V.25ter command &D, or &D will be ignored.

<mode>	*Description*
0	“Drop DTR” ignored but OK response given. ATH disconnects
1	“Drop DTR” and ATH ignored but OK response given
2	“Drop DTR” behavior according to &D setting. ATH disconnects. **Default value**

2.13 *AT+VTD DTMF tone duration*

Parameter Command Syntax:

Description	*Command*	*Return*
Set the duration of the	+VTD=<n>	OK

tone		ERROR
Query current setting	+VTD?	+VTD: <n>
List supported values	+VTD=?	+VTD: (1-255)

Description:

This refers to an integer <n> that defines the length of tones emitted as a result of the +VTS command. This does not affect the D command. A value different than zero causes a tone of duration <n>/10 seconds. The value zero causes a "manufacturer specific" value.

Abortability:

This command may not be aborted.

Defined values:

Table 1. <sn>: parameter

<sn>	*Description*
Integer	Value between 1 and 255 denoting 1/10's of second of the duration of the DTMF tones.

Unsolicited Result codes:

Not Applicable.

Execution Time:

Executed immediately, not time critical.

2.14 *AT+VTS DTMF and Tone Generation*

Description	*Command*	*Possible Responses*
Request transmission of DTMF tone(s)	AT+VTS=<DTMF>	OK ERROR
Show if the command is supported	AT+VTS=?	OK ERROR

Description:

This command allows the transmission of DTMF tones. These tones may be used, for example, when announcing the start of a recording period. The command is write only.

Note! The ATD-command is used only for dialing. It is not possible to generate arbitrary DTMF tones using the ATD command.

Note! The AT+VTS command is used only during a voice call.

<DTMF>	*Description*
ASCII character string	An ASCII character string with entries in the set 0-9, # and * separated by commas. Each entry is interpreted as a single ASCII character. Example: The string “8,9” sends two DTMF tones, “8” followed by “9” P is a further valid character which allows a pause of the same width of the tones to be inserted.

Example!
```
atd01252551624;
OK
at+vts="1,p,2,p,3"
OK
```

3 Control and Status

3.1 *ATQ Result Code Suppression*

Description	*Command*	*Possible Responses*
Set Result Code Suppression	ATQ[=]<value>	• OK • ERROR
Show the current setting	ATQ?	Q: <value>
Show if the command is supported	ATQ=?	Q: (list of supported <value>s)

Description:

Determines whether or not the DCE transmits result codes to the DTE. When result codes are being suppressed, no portion of any intermediate, final, or unsolicited result code - header, result text, line terminator, or trailer - is transmitted.

<value>	*Description*
0	DCE transmits result codes. **Default value**
1	Result codes are suppressed and not transmitted

3.2 *ATS0 Automatic Answer Control*

Description	*Command*	*Possible Responses*
Automatic answer control	ATS0=[<rcnt>]	• OK • ERROR
Show the current setting	ATS0?	<rcnt>
Show if the command is supported	ATS0=?	S0: (list of supported <rcnt>s)

Description:

Defines the automatic answering feature of the modem. A non-zero value specifies the number of rings before the call is answered.

Note! Call is always answered in the current fax class, regardless of whether the incoming call is voice, data, or fax.

<rcnt>	*Description*
0	Disable automatic answer. **Default value**
1-7	Answer after the specified number of rings

3.3 *ATS2 Escape Sequence Character*

Description	*Command*	*Possible Responses*
Set escape sequence character	ATS2=[<esc>]	• OK • ERROR
Show the current setting	ATS2?	<esc>
Show if the command is supported	ATS2=?	S2: (list of supported <esc>s)

Description:

Defines the character to be used as the escape sequence character when switching from on-line data mode to on-line command mode. The response to the command is modified to reflect the change.

<esc>	*Description*
43	Escape sequence character. **Default value**
0 to 255	Escape sequence character

Note! If the <esc> parameter is set to a value in the range of 128-255, the escape sequence detection is disabled.

3.4 *ATS3 Command Line Termination Character*

Description	*Command*	*Possible Responses*
Set Command Line Termination Character	ATS3=<value>	• OK • ERROR
Show the current setting	ATS3?	<value>
Show if the command is supported	ATS3=?	S3: (list of supported <value>s)

Description:

This S-parameter represents the decimal IA5 value of the character recognised by the DCE from the DTE to terminate an incoming command line. It is also generated by the DCE as part of the header, trailer, and terminator for result codes and information text, along with the S4 parameter.

The previous value of S3 is used to determine the command line termination character for entry of the command line containing the S3 setting command. However, the result code issued uses the value of S3 as set during the processing of the command line. For example, if S3 was previously set to 13 and the command line “ATS3=30” is issued, the command line is terminated with a <CR> character (IA5 0/13), but the result code issued uses the character with the ordinal value 30 (IA5 2/14) in place of the <CR>.

<value>	*Description*
13	Command line termination character, **Default value**
0 to 127	Command line termination character

3.5 *ATS4 Response Formatting Character*

Description	*Command*	*Possible Responses*
Set Response Formatting Character	ATS4=<value>	• OK • ERROR
Show the current setting	ATS4?	<value>
Show if the command is supported	ATS4=?	S4: (list of supported <value>s)

Description:

This S-parameter represents the decimal IA5 value of the character generated by the DCE as part of the header, trailer, and terminator for result codes and information text, along with the S3 parameter (see the description of the V parameter for usage).

If the value of S4 is changed in a command line, the result code issued in response to that command line will use the new value of S4.

<value>	*Description*

10	Formatting character. **Default value** Note: ASCII character 10 is equivalent to <LF>
0 to 127	Formatting character

3.6 *ATS5 Command Line Editing Character (BACKSPACE)*

Description	*Command*	*Possible Responses*
Request Command Line Editing Character	ATS5=<value>	• OK • ERROR
Show the current setting	ATS5?	<value>
Show if the command is supported	ATS5=?	S5: (list of supported <value>s)

Description:

This S-parameter represents the decimal IA5 value of the character recognised by the DCE as a request to delete from the command line the immediately preceding character.

<value>	*Description*
8	Line editing character. **Default value**
0 to 127	Line editing character

3.7 *ATS6 Blind Dial Delay Control*

Description	*Command*	*Possible Responses*
Blind dial delay control	ATS6=[<dly>]	OK
Show the current setting	ATS6?	<dly>
Show if the command is supported	ATS6=?	S6: (list of supported <dly>s)

Description:

Included for compatibility. No functionality

<dly>	*Description*
2	Wait two seconds before blind dialling. **Default value**
2-255	Number of seconds to wait before blind dialling

3.8 *ATS7 Connection Completion Timeout*

Description	*Command*	*Possible Responses*
Set connection completion timeout	ATS7=[<tmo>]	• OK • ERROR
Show the current setting	ATS7?	<tmo>
Show if the command is supported	ATS7=?	S7: (list of supported <tmo>s)

Description:

Defines the maximum time allowed between completion of dialling and the connection being established. If this time is exceeded then the connection is aborted.

<tmo>	*Description*
50	Timeout value in seconds. **Default value**
1-255	Timeout value in seconds

3.9 *ATS8 Comma Dial Modifier Delay Control*

Description	*Command*	*Possible Responses*
Set Comma Dial Modifier Delay Control	ATS8=[<dly>]	• OK • ERROR
Show the current setting	ATS8?	<dly>
Show if the command is supported	ATS8=?	S8: (list of supported <dly>s)

Description:

Included for compatibility. No functionality

<dly>	*Description*
2	The value of the dial modifier delay in seconds. **Default value**
1-255	The value of the dial modifier delay in seconds

3.10 *ATS10 Automatic Disconnect Delay Control*

Description	*Command*	*Possible Responses*
Set Automatic Disconnect Delay Control	ATS10=[<val>]	• OK • ERROR
Show the current setting	ATS10?	<val>
Show if the command is supported	ATS10=?	S10: (list of supported <val>s)

Description:

Included for compatibility. No functionality

<val>	*Description*
2	Remains connected for two tenths of a second. **Default value**
1-254	Number of tenths of a second of delay

3.11 *AT*ECAM Ericsson Call Monitoring*

Description	*Command*	*Possible Responses*
Set Call Monitoring on or off	AT*ECAM=<onoff>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ECAM?	• *ECAM: <onoff> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ECAM=?	• *ECAM: list of supported <onoff>s • +CME ERROR: <err> • OK • ERROR

Description:

This command activates or deactivates the call monitoring function in the ME. When this log function is activated in the ME, the ME informs about call events, such as incoming call, connected, hang up etc.

It is preferable that the current status shall always be sent with result code *ECAV when activating the log function. The purpose of this is two fold:

- to gather relevant information for the call log in a TE;

- to make it possible for the TE to display call state information for an ongoing call.

<onoff>	*Description*
0	The call log function is disabled (off). **Default value**
1	The call log function is enabled (on)

Unsolicited result codes:

*ECAV:
<ccid>,<ccstatus>,<calltype>,[<processid>],[<exitcause>],
[<number>,<type>]

<ccid>	*Description*
1 to 7	Integer type. A number which uniquely defines a call in the ME (= number of call control process). There can not be two call id's with the same number simultaneously. The maximum number of call control processes are 7, which are 5 multiparty members, one call on hold, and one waiting call

<ccstatus>	*Description*
0	Idle
1	Calling (MO)
2	Connecting (MO)
3	Active (connection between A and B)
4	Hold
5	Waiting (MT)
6	Alerting (MT)
7	Busy

<calltype>	*Description*
1	Voice
2	Data
128	Voice2

<processid>	*Description*
Integer	Reported when returning to the Idle state (<ccstatus>=0)
	8 = H'08 = CC (Call Control)
	68 = H'44 = MM (Mobile Management)

	69 = H'45 = MS (Mobile Station)
	122 = H'7A = RR (Radio Resources)

<exitcause>	Description
Integer	Exit cause according to GSM 04.08 reported when returning to Idle state (<ccstatus> = 0)

<number>	*Description*
String	String type ME number of format specified by <type>. Only valid for <ccstatus> = 1 (Calling)

<type>	*Description*
	Type of address octet in integer format (refer to GSM 04.08, subclause 10.5.4.7)
129	ISDN/Telephony numbering plan, national/international unknown. **Default if no "+" in sca**
145	ISDN/Telephony numbering plan, international number. **Default if "+" in sca.**
161	ISDN/Telephony numbering plan, national number
128 to 255	Other values refer to GSM 04.08 section 10.5.4.7. Only valid for <ccstatus> = 1 (Calling)

Example!
```
AT*ECAM?
*ECAM: 0

AT*ECAM=1
OK
```

3.12 *AT*ECIND Expanded Indicator Control*

Description	*Command*	*Possible Responses*
Set unsolicited message reporting on/off for entire list of indicators	AT*ECIND=1,<r1>,<r2>,<r3>,….,<r12>[,<r13>]…[,<r20>]	• OK • ERROR
Set unsolicited message reporting on/off for a single specific indicator	AT*ECIND=2,<ind_no>,<on-off>	• OK • ERROR
Display unsolicited message reporting states for all indicators	AT*ECIND=3	• *ECIND: 3,<r1>,<r2>,<r3>,….,<r12>[,<r13>]…[,<r20>]

Display current value for all indicators	AT*ECIND=4	•*ECIND: 4,<v1>,<v2>,<v3>,…..,<v12>[,<v13>]…[,<v20>]
Show if the command is supported, and input parameters	AT*ECIND=?	•*ECIND: (List of supported operational codes, <ind_no>s, <on-off>s, <rn>s) •
Unsolicited report		•*ECIND: 5,<ind_no>,<vn>

Description:

This command enables/disables the unsolicited reporting of individual indicators. The command also returns the current status of all or selected indicators.

An operating code has been assigned (and hard-coded, 1-4, in the table above) for each possible kind of operation using this command. The same operating code is returned as the first parameter in the solicited and unsolicited responses.

Unsolicited reports for all indicators are default off.

The settings are persistent and will remain after a power cycle.

Ordinal number and <ind_no>	*Description*
1	Signal strength indicator (0-5)
2	Service indicator
3	SMS message waiting to be read
4	Call in progress indicator
5	SMS memory full
6	Roaming indicator
7	Voice message waiting, line 1
8	Voice message waiting, line 2
9	Fax message waiting, line 1
10	Fax message waiting, line 2
11	Email message waiting, line 1
12	Email message waiting, line 2
13 .. 20	Reserved

Parameter	*Description*
<rn>, n=1-20	Indicator reporting state, 0=no report, 1=report

<vn>, n=1-20	Value for each indicator. For signal strength, values are 0-5, others 0=inactive, 1=active
<on-off>	0=no report, 1=report

3.13 *AT*ECLCC List Current Calls*

Description	*Command*	*Possible Responses*
Set unsoliciting reporting on/off	AT*ECLCC=<n>	• OK • ERROR
Read the current setting	AT*ECLCC?	• *ECLCC: <n> • OK • ERROR
Read the current call status	AT*ECLCC	• *ECLCC: <ccid>,<dir>,<ccstatus>,<calltype>,<mpty>[,<exitcause>,<number>,<type>]<CR> •[,<ccid>,<dir>,<ccstatus>,<calltype>,<mpty>[,<exitcause>,<number>,<type>]]<CR> • ..etc for all calls • OK • ERROR
Show list of supported modes	AT*ECLCC=?	• *ECLCC: (list of supported <n>s) • OK • ERROR
Unsolicited report		• *ECLCC: <ccid>,<dir>,<ccstatus>,<calltype>,<mpty>[,<exitcause>,<number>,<type>]

Description:

This command enables and disables unsolicited reports of call status. It is similar to AT*ECAM (*ECAV) and the GSM standard unsolicited report +CLCC, but with a slightly different set of parameters.

When entering the command without any parameters, the current status of all calls is returned.

The command is operational with or without a SIM card available.

The setting is not persistent after a power cycle.

<n>	*Description*
0	Call status reporting is disabled. **Default value.**

1	Call status reporting is enabled.

<ccid>	*Description*
1-7	Id of the call for which progress change is reported.

<dir>	*Description*
0	Mobile Originated Call
1	Mobile Terminated Call.

<ccstatus>	*Description*
0	IDLE.
1	CALLING. Mobile Originated (outgoing) call started.
2	CONNECTING. Mobile Originated (outgoing) call in the process of establishing a connection.
3	ACTIVE. Connection established between A and B.
4	HOLD. Connection put on hold.
5	WAITING. Mobile Terminated (incoming) call waiting.
6	ALERTING. Mobile Terminated (incoming) call ringing.
7	BUSY.
8	CALL FAILED. See <exitcause> for reason.

<calltype>	*Description*
1	Voice.
2	Data
3	FAX.
128	Voice 2.

<mpty>	*Description*
0	Call is not one of multiparty (conference) call parties
1	Call is one of multiparty (conference) call parties

<exitcause>: This is an integer value showing why the call ended. Only reported when returning to the IDLE state. The exit code is in most cases delivered directly from the network and therefore the codes can differ from operator to operator. There may also be more exit codes than listed in the table below.

<exitcause>	*Description*
1	Unassigned (unallocated) number.
3	No route to destination.
6	Channel unacceptable.
8	Operator determined barring.
16	Normal call clearing.
17	User busy.
18	No user responding.
19	User alerting, no answer.
21	Call rejected.
22	Number changed.
25	Pre-emption.
26	Non selected user clearing.
27	Destination out of order.
28	Invalid number format (incomplete number).
29	Facility rejected.
30	Response to STATUS ENQUIRY.
31	Normal, unspecified.
34	No circuit/channel available.
38	Network out of order.
41	Temporary failure.
42	Switching equipment congestion.
43	Access information discarded.
44	requested circuit/channel not available.
47	Resources unavailable, unspecified.
49	Quality of service unavailable.
50	Requested facility not subscribed.
55	Incoming calls barred within the CUG.
57	Bearer capability not authorized.
58	Bearer capability not presently available.
63	Service or option not available, unspecified.
65	Bearer service not implemented.
68	ACM equal to or greater than ACMmax.
69	Requested Facility not yet implemented.
70	Only Restricted Digital information bearer capability is

	available.
79	Service or option not implemented, unspecified.
81	Invalid Transaction Identifier value.
87	User not member of CUG.
88	Incompatible Destination.
91	Invalid transit network selection.
95	Semantically incorrect message.
96	Invalid mandatory information.
97	Message type non-existent or not implemented.
98	Message type not compatible with protocol state.
99	Information element non-existent or not implemented
100	Conditional IE Error
101	Message not compatible with protocol state
102	Recovery on timer expiry
111	Protocol error, unspecified
127	Inter-working unspecified
150	Radio Path Not Available
210	The network did not send a cause
211	Max Random Access channels used – Uplink failure
212	Access barred
213	Paging
214	Rejected by the Base station
215	No cell available
216	SIM has been removed
218	Ciphering Error – No Ciphering key
219	Reestablish not allowed
220	Establish failure in MPH
221	Data link error
222	Phone is not off hook
223	Reestablish in progress
224	Establish error
226	RR connection failure
227	Forced registration failure
228	GPRS detached
229	GPRS suspended
230	PDCH release

231	GSM detached
255	Empty

<number>: A string containing the phone number of the party calling the module (Mobile Terminated) or the party called from the module (Mobile Originated). The <number> is only shown for state CALLING (1) and ALERTING (6).

<number>	*Description*
String	String of valid dial characters (‘0’-‘9’, ‘+’, ‘#’, ‘*’, ‘A’, ‘B’, and ‘C’)

<type>: This is an integer identifying the type of number displayed in <number>. The integer should be converted into a binary number for decoding using the tables below:

Bit8	*Bit7*	*Bit6*	*Bit5*	*Description*
0	0	0	0	Unknown number.
0	0	0	1	International number.
0	0	1	0	National number.
0	0	1	1	Network specific number.
0	1	0	0	Dedicated access, short code
0	1	0	1	Reserved
0	1	1	0	Reserved
0	1	1	1	Reserved for extension

Bits 1-4 only apply to bits 5-8 = 0000, 0001, 0010 and 0100.

Bit4	*Bit3*	*Bit2*	*Bit1*	*Description*
0	0	0	0	Unknown numbering plan.
0	0	0	1	ISDN/telephony numbering plan. (Recommendation E.164/E.163).
0	0	1	0	Reserved.
0	0	1	1	Data numbering plan (Recommendation X.121).
0	1	0	0	Telex numbering plan (Recommendation F.69).
0	1	0	1	Reserved.
0	1	1	0	Reserved.
0	1	1	1	Reserved.
1	0	0	0	National numbering plan.

1	0	0	1	Private numbering plan.
1	0	1	0	Reserved.
1	0	1	1	Reserved for CTS (see 3GPP TS 44.056 [91]).
1	1	0	0	Reserved.
1	1	0	1	Reserved.
1	1	1	0	Reserved.
1	1	1	1	Reserved for extension.

3.14 *AT*EDST Ericsson Daylight Saving Time*

Description	*Command*	*Possible Responses*
Set Daylight Saving Time	AT*EDST=<dst>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*EDST?	• *EDST: <dst> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EDST=?	• *EDST: (list of supported <dst>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command sets the daylight saving time hours.

Note! This command affects the MS clock set with the AT+CCLK command. To avoid confusion it is recommended the daylight saving time (DST) is set with this command before setting the actual local time with AT+CCLK.

<dst>	*Description*
0	Standard time
1	Daylight saving time, +1 hour
2	Daylight saving time, +2 hours

3.15 *AT*EMAR Ericsson Master Reset*

Description	*Command*	*Possible Responses*
Perform a master reset in the MS	AT*EMAR=<ME lock code>	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EMAR=?	• +CME ERROR: <err> • OK • ERROR

Description:

This command requests the MS to reset user data. The user data in the MS will be reset to the default values. This command also unlocks the MS.

<ME lock code>	*Description*
String	Security code (ME lock code) must be verified before performing the master reset, see also AT+CLCK

3.16 *AT*E2RESET Restart module*

Description	*Command*	*Possible Responses*
Perform a restart	AT*E2RESET	• OK • ERROR
Shows if the command is supported or not	AT*E2RESET=?	• OK • ERROR

Description:

This command restarts the module.

3.17 *AT*EPEE Ericsson Pin Event*

Description	*Command*	*Possible Responses*
Requests the MS to inform when the PIN code has been inserted	AT*EPEE=<onoff>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*EPEE?	• *EPEE: <onoff> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EPEE=?	• *EPEE: (list of supported <onoff>s) • +CME ERROR: <err> • OK

	• ERROR

Description:

The command requests the MS to report when the PIN code has been inserted and accepted.

<onoff>	*Description*
0	Request for report on inserted PIN code is not activated (off). **Default value**
1	Request for report on inserted PIN code is activated (on)

3.18 *AT+CALA Set Alarm*

Description	*Command*	*Possible Responses*
Set an alarm time in the ME	AT+CALA=<time>[,<n>[,<type>[,<text>[,<recurr>[,<silent>]]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CALA?	• +CALA: <time1>,<n1>,<type1>,[<text1>],[<recurr1>],<silent1>[<CR><LF>+CALA: <time2>,<n2>,<type2>,[<text2>],[<recurr2>],<silent2>[…]]+CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CALA=?	• +CALA: (list of supported <n>s),(list of supported type>s),<tlength>,<rlength>,(list of supported <silent>s) • +CME ERROR: <err> • OK • ERROR

Description:

The command sets an alarm time in the ME. An array of different alarms can be set and each may be recurrent. If alarm setting fails, ERROR: <err> is returned.

When the alarm is timed out and executed, the unsolicited result code +CALV: <n> is always returned, even if the alarm is setup to be silent.

The alarm time is set in hours and minutes. Date, seconds and time zone cannot be set.

The read command returns the list of current active alarm settings in the ME.

Show returns the supported array index values, alarm types and maximum length of the text strings.

<time>	*Description*
string type value	Refer to the AT+CCLK command. Note! Only hours and minutes are used i.e. date, time zone and seconds are not used

<n>	*Description*
Integer type	Index identifying an active alarm

Note! The number of active alarms is manufacturer and product specific.

<tlength>	*Description*
Integer type	Maximum length of <text> parameter

Note! The maximum length of the <text> parameter is manufacturer and product specific.

<recurr>	*Description*
Format: “<1..7>[,<1..7>[…]]”	For setting an alarm for one or more days in the week. The digits 1 to 7 correspond to the days in the week, Monday (1), …, Sunday (7). Example: The string “1,2,3,4,5” may be used for setting an alarm for all weekdays
Format:“0”	For setting an alarm for all days in the week

<rlength>	*Description*
Integer type	Maximum length of the <recurr> parameter

Unsolicited result codes:

+CALV: <n>

Example!
```
AT+CALA=?
 +CALA: (1-2),(),(),(13),()
```

Recurrent:
```
AT+CALA="12:00",1,0
```

OK

```
AT+CALA?
+CALA: "12:00",1,,,
```

Single:
+CALA: "15:40",1,,,

OK

Technical Description:

Only a single active alarm can be set and this can only be set to an hour/minute, not to a date/day.

3.19 *AT+CALD Alarm Delete*

Description	*Command*	*Possible Responses*
Delete an alarm	AT+CALD=<n>	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CALD=?	• +CALD: (list of supported <n>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command removes an active alarm.

<n>	*Description*
Integer type	Index identifying an active alarm

3.20 *AT+CCLK Set Clock and Date*

Description	*Command*	*Possible Responses*
Set the real time clock of the ME	AT+CCLK=<time>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CCLK?	• +CCLK: <time> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CCLK=?	• OK • ERROR

Description:

Sets the real time clock of the ME. If setting fails in an ME, error +CME ERROR: <err> is returned. Read command returns the current setting of the clock.

<time>	*Description*
string type value	Format is “yy/mm/dd,hh:mm:ss±zz”, where characters indicate year (two last digits), month, day, hour, minutes, seconds and time zone (indicates the difference, expressed in quarters of an hour, between the local time and GMT; range -47...+48), e.g. 6th of May 1994, 22:10:00 GMT+2 hours reads “94/05/06,22:10:00+08” NOTE: If the ME does not support time zone information then the three last characters of <time> are not returned by +CCLK?

Example! AT+CCLK?
+CCLK: “00/01/01,22:54:48+00”

OK

AT+CCLK=“19/11/02,09:30:00+00”
OK

3.21 *AT+CEER Extended Error Report*

Description	*Command*	*Possible Responses*
Request an Extended Error Report	AT+CEER	• +CEER: <report> • OK • ERROR
Show if the command is supported	AT+CEER=?	• OK • ERROR

Description:

Causes the TA to return one or more lines of information text <report>. Typically, the text will consist of a single line containing the failure information given by the GSM network in text format.

<report>	*Description*
characters	The total number of characters, including line terminators, in the information text shall not exceed 2041 characters. Text shall not contain the sequence 0<CR> or OK<CR>

3.22 *AT+CFUN Set ME Functionality*

Description	*Command*	*Possible Responses*
Set MS functionality	AT+CFUN=<fun>	• +CME ERROR: <err> • OK
Show the current setting	AT+CFUN?	• +CFUN: <fun> • +CME ERROR: <err>
Show if the command is supported	AT+CFUN=?	• +CFUN: (list of supported <fun>s) • +CME ERROR: <err>

Description:

Selects the level of functionality <fun> in the MS. Level “full functionality” results in the highest level of power drawn. “Minimum functionality” results in the minimum power drawn. Manufacturers may also specify levels of functionality between these two end levels.

Test command returns values supported by the ME as a compound.

Note! “AT+CFUN=” is interpreted as “AT+CFUN=0”.

<fun>	*Description*
0	Minimum functionality. **Default value** Note: The ME is turned off
1	Full functionality.

3.23 *AT+CIND Indicator Control*

Description	*Command*	*Possible Responses*
Set Indicator Control	AT+CIND=[<ind> [,<ind>[,…]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CIND?	• +CIND: <ind>,<ind>,… • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CIND=?	• +CIND: (<descr>,(list of supported <ind>s)), (<descr>,(list of supported <ind>s)),… • +CME ERROR: <err> • OK

	• ERROR

Description:

Used to set the values of ME indicators. <ind> value 0 means that the indicator is off (or in state which can be identified as “off” state), 1 means that indicator is on (or in a state which is more substantial than “off” state), 2 is more substantial than 1, and so on. If the indicator is a simple on/off style element, it has values 0 and 1. The number of elements is ME specific. If the ME does not allow setting of indicators or it is not currently reachable, +CME ERROR: <err> is returned. If a certain indicator is not writable, it cannot be set. If the parameter is an empty field, the indicator will keep the previous value.

Test command returns pairs, where string value <descr> is a maximum 16 character description of the indicator and compound value is the allowed values for the indicator. If ME is not currently reachable, +CME ERROR: <err> is returned (refer to GSM 07.07).

<ind>	*Description*
Integer type	Value shall be in range of corresponding <descr>

<descr>	*Description*
“signal”	Signal quality (0-5)
“service”	Service availability (0-1)
“sounder”	Sounder activity (0-1)
“message”	Message received (0-1)
“call”	Call in progress (0-1)
“roam”	Roaming indicator (0-1)
“sms full”	A short message memory storage in the MT has become full (1), or memory locations are available (0); i.e. the range is (0-1)

3.24 *AT+CLAC List all available AT Commands*

Command	*Possible Responses*
+CLAC	<AT Command1> [<CR> <LF> <AT Command2>[…]] +CME ERROR: <err>

+CLAC=?	+CME ERROR: <err>

Description:

Causes the ME to return one or more lines of AT commands. This command has the same functionality as AT*.

Note! This command only returns the AT commands that are available to the user.

3.25 *AT+CLANSet Language*

Description	*Command*	*Possible Responses*
Set MT language	AT+CLAN=<code>	• +CME ERROR: <err>
Show the current setting	AT+CLAN?	• +CLAN: <code> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CLAN=?	• +CLAN: (list of supported <code>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command sets the language in the MT. If setting fails, a MT error, +CME ERROR: <err> is returned.

The <code>-parameter is a two-letter abbreviation of the language. The language codes consist of two characters, e.g. "sv", "en" etc.

The complete set of language codes to be used are manufacturer specific. Some examples are described under <code> For a complete list see ISO 639.

The read command gives the current language as output. If the language has been set to "AUTO", the read command returns the current language set from the SIM-card. Hence, the "AUTO"-code is never returned by the read-command.

Test command returns supported <code>s.

Table 1. <code> : parameter

<code>	*Description*
"AUTO"	Read language from SIM-card
de	German
It	Italian

en	English
fr	French
es	Spanish
sv	Swedish
da	Danish
no	Norwegian
fi	Finnish

Note! This is not an exhaustive list of the cades available.

3.26 *AT+CMEEMobile Equipment Error*

Description	*Command*	*Possible Responses*
Request GSM Mobile Equipment Error Control	AT+CMEE=[<n>]	• OK • ERROR
Show the current setting	AT+CMEE?	• +CMEE: <n> • OK • ERROR
Show if the command is supported	AT+CMEE=?	• +CMEE: (list of supported <n>s) • OK • ERROR

Description:

Disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the ME. When enabled, ME related errors cause +CME ERROR: <err> final result code instead of the regular ERROR final result code. ERROR is returned normally when error is related to syntax, invalid parameters, or TA functionality. For more information, refer to “+CME ERROR (Mobile Equipment Error Code)”, page 13.

<n>	*Description*
0	Disable +CME ERROR: <err> result code and use ERROR instead. **Default value**
1	Enable +CME ERROR: <err> result code and use numeric <err> values (see page 14)
2	Enable +CME ERROR: <err> result code and use verbose <err> values (see page 14)

3.27 *AT+CMER Mobile Equipment Event Reporting*

Description	*Command*	*Possible Responses*
Set ME Activity Status	AT+CMER=[<mode> [,<keyp>[,<disp> [,<ind>[,<bfr>]]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CMER?	• +CMER: <mode>,<keyp>,<disp>, <ind>,<bfr> • OK • ERROR
Show if the command is supported	AT+CMER=?	• +CMER: (list of supported s), (list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s),(list of supported <bfr>s) • OK • ERROR

Description:

The command enables or disables the sending of unsolicited result codes from the ME to the TE in the case of key pressings, display changes, and indicator state changes. <mode> controls the processing of unsolicited result codes specified within this command. <bfr> controls the effect on buffered codes when <mode> 1, 2 or 3 is entered. If the ME does not support setting, +CME ERROR: <err> is returned.

Test command returns the modes supported by the TA as compound values.

<mode>	*Description*
0	Buffer unsolicited result codes in the TA; if TA result code buffer is full, codes can be buffered in some other place or the oldest ones can be discarded
3	Forward unsolicited result codes directly to the TE; TA-TE link specific inband technique used to embed result codes and data when TA is in on-line data mode

<ind>	*Description*
0	No indicator event reporting
1	Indicator event reporting using result code +CIEV: <ind>,<value>. <ind> indicates the indicator order number (as specified for +CIND) and <value> is the new value of indicator. Only those indicator events, which are not caused by +CIND shall be indicated by the TA to the TE

<bfr>	*Description*
0	TA buffer of unsolicited result codes defined within this command is cleared when <mode> 1...3 is entered

Unsolicited Result Codes:

+CKEV: <key>,<press>

+CIEV: <ind>,<value>

3.28 *AT+CPAS ME Activity Status*

Description	*Command*	*Possible Responses*
Execute ME Activity Status	AT+CPAS[=<mode>]	• +CPAS: <pas> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CPAS=?	• +CPAS: (list of supported <pas>s) • +CME ERROR <err> • OK • ERROR

Description:

Returns the activity status <pas> of the ME. It can be used to interrogate the ME before requesting action from the ME.

When the command is executed without the <mode> argument, the command returns <pas> values from 0 to 128 (for supported values see table below). When, on the other hand, the command is executed with the <mode> argument set to 1, the command may return Ericsson specific <pas> values from 129 to 255 (for supported values see the table below).

Test command returns values supported by the ME as a compound value: refer to GSM 07.07.

<pas>	*Description*
0	Ready (ME allows commands from TA/TE)
3	Ringing (ME is ready for commands from TA/TE, but the ringer is active)
4	Call in progress (ME is ready for commands from TA/TE, but a call is in progress)
129	Not in call
130	Mobile oriented call in progress. This is a sub-state to 'call in progress'
131	Mobile terminated call in progress. This is a sub-state to 'call in progress'

<mode>	*Description*
1	Allows the CPAS to return Ericsson specific <pas> values, such as 129, 130 and 131

Example!

```
AT+CPAS=?
+CPAS: (0,3,4,129,130,131)

OK

AT+CPAS
+CPAS: 0

OK
```

3.29 *AT+CPIN PIN Control*

Description	*Command*	*Possible Responses*
Request PIN Control	AT+CPIN=<pin>[,<newpin>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CPIN?	• +CPIN: <code> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CPIN=?	• +CME ERROR: <err> • +CPIN: (supported <code>s) • OK • ERROR

Description:

Sends the password to the ME, which is necessary to make the ME operational (SIM PIN, SIM PUK or PH-SIM). If the PIN is to be entered twice, the TA autonomously repeats the PIN. If no PIN request is pending, no action is taken towards the ME and an error message (+CME ERROR <err>) is returned to the TE.

If the PIN required is PUK, the second pin is required. This second PIN, <newpin>, is used to replace the old PIN in the SIM.

Note! Commands which interact with the ME that are accepted when the ME has a pending request for SIM PIN, SIM PUK or PH-SIM are: +CGMI, +CGMM, +CGMR, +CGSN, +CFUN, +CMEE +CPIN, L and M.

<pin>,<newpin>	*Description*
string	The range for the SIM PIN and the PH- SIM PIN is 4 - 8 digits. The SIM PUK consists of 8 digits

<code>	*Description*
READY	ME is not pending for any password
SIM PIN	ME is waiting SIM PIN to be given

SIM PUK	ME is waiting SIM PUK to be given
PH-SIM PIN	ME is waiting PHone-to-SIM card password to be given
SIM PIN2	ME is waiting SIM PIN2 to be given. This <code> is recommended to be returned only when the last executed command resulted in PIN2 authentication failure (i.e. +CME ERROR: 17); if PIN2 is not entered correctly after the failure, it is recommended that ME does not block its operation
SIM PUK2	ME is waiting SIM PUK2 to be given. This <code> is recommended to be returned only when the last executed command resulted in PUK2 authentication failure (i.e. +CME ERROR:18); if PUK2 and new PIN2 are not entered correctly after the failure, it is recommended that ME does not block its operation.
BLOCKED	The SIM cards is blocked for the user

<err>	*Description*
0	ME failure
5	PH-SIM PIN required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
24	Text string too long
25	Invalid characters in text string
100	Unknown

Example! AT+CPIN=“0000”
OK

3.30 *AT+CPWD Change Password*

Description	*Command*	*Possible Responses*
Request facility lock	AT+CPWD=<fac>, <oldpwd>, <newpwd>	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CPWD=?	• +CPWD: (<fac1>,<pwdlength1>), (<fac2>,<pwdlength2>),… • +CME ERROR <err> • OK • ERROR

Description:

Sets a new password for the facility lock function defined by command Facility Lock +CLCK.

Test command returns a list of pairs which present the available facilities and the maximum length of their password.

<fac>	*Description*
“PS”	PH-SIM (lock ME to SIM card) (ME asks password when other than current SIM card inserted)
“SC”	SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued)
“P2”	SIM PIN2
“AO”	BAOC (Barr All Outgoing Calls) (refer GSM 02.88 clause 1)
“OI”	BOIC (Barr Outgoing International Calls) (refer GSM 02.88 clause 1)
“AI”	BAIC (Barr All Incoming Calls) (refer GSM 02.88 clause 2)
“IR”	BIC-Roam (Bar Incoming Calls when Roaming outside the home country) (refer GSM 02.88 clause 2)
“OX”	BOIC-exHC (Barr Outgoing International Calls except to Home Country) (refer GSM 02.88 clause 1)
“AB”	All Barring services (refer GSM 02.30)
“AG”	All outGoing barring services (refer GSM 02.30)
“AC”	All inComing barring services (refer GSM 02.30)

<oldpwd>	*Description*
string type	<oldpwd> shall be the same as password specified for the facility from the ME user interface or with the change password

	command, +CPWD

<newpwd>	*Description*
string type	<newpwd> is the new password, maximum length of password can be determined with <pwdlength>

<pwdlength>	*Description*
Integer type	Maximum length of the password for the facility

<err>	*Description*
0	ME failure
3	Operation not allowed
5	PH-SIM PIN required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
23	Text string too long
24	Invalid characters in text string
100	Unknown
101..255	Reserved by ETS

Example! AT+CPWD=“SC”,“0000”,“0001”
OK

3.31 *AT+CR Service Reporting Control*

Description	*Command*	*Possible Responses*
Set Service Reporting Control	AT+CR=<mode>	• OK • ERROR
Show the current setting	AT+CR?	• +CR: <mode> • OK • ERROR
Show if the command is supported	AT+CR=?	• +CR: (list of supported <mode>s) • OK • ERROR

Description:

Enables or disables display of intermediate bearer capability reports during the handshake phase.

<mode>	*Description*
0	Disable reporting. **Default value**
1	Enable reporting

Intermediate Result Codes:

+CR: <serv>

3.32 *AT+CRC Cellular Result Code*

Description	*Command*	*Possible Responses*
Set Cellular Result Code option	AT+CRC=[<mode>]	• OK • ERROR
Show the current setting	AT+CRC?	• +CRC: <mode> • OK • ERROR
Show if the command is supported	AT+CRC=?	• +CRC: (list of supported <mode>s) • OK • ERROR

Description:

Command controls whether or not;

- the extended format of incoming call indication;
- or GPRS network request for PDP context activation;

- or notification for VBS/VGCS calls is used.

When enabled, an incoming call is indicated to the TE with unsolicited result code +CRING: <type> instead of the normal RING.

Test command returns values supported by the TA as a compound value.

<mode>	*Description*
0	Disables extended format
1	Enables extended format

Unsolicited Result Codes:

+CRING: <type>

3.33 *AT+CSAS Save Settings*

Description	*Command*	*Possible Responses*
Save Settings	AT+CSAS[=<profile>]	• +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CSAS=?	• +CSAS: (list of supported <profile>s) • +CMS ERROR: <err> • OK • ERROR

Description:

Saves active message service settings to a non-volatile memory. A TA can contain several settings profiles. Settings specified in commands Service Centre Address +CSCA, Set Message Parameters +CSMP and Select Cell Broadcast Message Types +CSCB (if implemented) are saved. Certain settings may not be supported by the storage (e.g. SIM SMS parameters) and therefore can not be saved.

Test command shall display the supported profile numbers for reading and writing of settings.

<profile>	*Description*
0..255	Manufacturer specific profile number where settings are to be stored. **Default value is 0**

Note! It is recommended that the AT&W command is used in preference to AT+CSAS. This is only included for compatibility.

3.34 *AT+CSQ Signal Strength*

Description	*Command*	*Possible Responses*
Show the Signal Strength	AT+CSQ	• +CSQ: <rssi>,<ber> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CSQ=?	• +CSQ: (list of supported <rssi>s),(list of supported <ber>s) • +CME ERROR <err> • OK • ERROR

Description:

Returns the received signal strength indication <rssi> and channel bit error rate <ber> from the ME. Test command returns values supported by the TA as compound values.

<rssi>	*Description*
0	–113dBm or less
1	–111dBm
2..30	–109… –53dBm
31	–51dBm or greater
99	Not known or not detectable

<ber>	*Description*
0..7	As RXQUAL values in the table in GSM 05.08 subclause 8.2.4
99	Not known or not detectable

Example!
```
AT+CSQ
+CSQ: 13,99

OK
```

Note! An alternative command to this is AT*E2EMM as it gives more information and a precise reading in dBm.

3.35 *AT+CTZU Automatic Time Zone Update*

Description	*Command*	*Possible Responses*
Enable and disable automatic time zone update via NITZ	AT+CTZU=<onoff>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CTZU?	• +CTZU: <onoff> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CTZU=?	• +CTZU: (list of supported <onoff>s) • +CME ERROR: <err> • OK • ERROR

Enables and disables the automatic time zone update via NITZ. If setting fails in an ME error, +CME ERROR <err> is returned.

<onoff>	*Description*
0	The automatic time zone update is disabled (off). **Default value**
1	The automatic time zone update is enabled (on)

Note! This is highly network dependent. Most networks around the world have not implemented this and as such the unit will be unable to sychronise to network time.

4 Audio

Note! *E2EAMS and *E2APR are new commands that replace the functionary offered by the *EALR, *EAMS, *EARS and *ELAM commands. Use the new commands in new applications. The old commands are included for compatibility.

4.1 *AT*E2EAMS Ericsson M2M Audio Profile Modification*

Description	*Command*	*Possible Responses*
Request operation with audio profile	AT*E2EAMS= <op>[,<TxPGA>, <RxPGA>,<SideToneGain>, <AuxInGain>,<MicInGain>, <TxAGC>,<Volume>, <MaxVolume>,<MicPath>, <SpkPath>,<TxPCM>, <RxPCM>,<HFAlgorithm>, <LocalAudio>,<TxGainLow>,< MicVolt2V>,<SideTone>, <NoiseRed>,<EchoCancel>,<A nalogRing>,][,<val>]]	• ERROR • OK
Show the current setting	AT*E2EAMS?	• *E2EAMS: <TxPGA>, <RxPGA>, <SideToneGain>, <AuxInGain>, <MicInGain>, <TxAGC>,<Volume>, <MaxVolume>, <MicPath>,<SpkPath>, <TxPCM>,<RxPCM>, <HFAlgorithm>, <LocalAudio>, <TxGainLow>, <MicVolt2V>, <SideTone>,<NoiseRed>, <EchoCancel>, <AnalogRing> OK • ERROR
Show if the command is supported	AT*E2EAMS=?	• *E2EAMS: (list of supported <op>s) • ERROR

Description:

This command allows the modification and configuration of the current audio profile. An audio profile is a set of data which uniquely defines the way in which the audio paths, gains, DSP algorithms and switch setting are configured. There are several

audio profiles available in non-volatile storage, and the current profile can be modified by use of the AT*E2APR command.

The AT*E2EAMS command allows the user to:

- configure the whole profile, specifying each audio parameter in a comma separated list;
- set a single parameter, given by its parameter number;
- save the current profile to non-volatile memory under the current profile number (see AT*E2APR).

The current audio settings can also be displayed by running the read command AT*E2EAMS?

Default audio settings are given in AT*E2APR.

Abortability:

This command may not be aborted.

Refer to the diagram below to understand which parts of the audio circuit are affected by the various parameters.

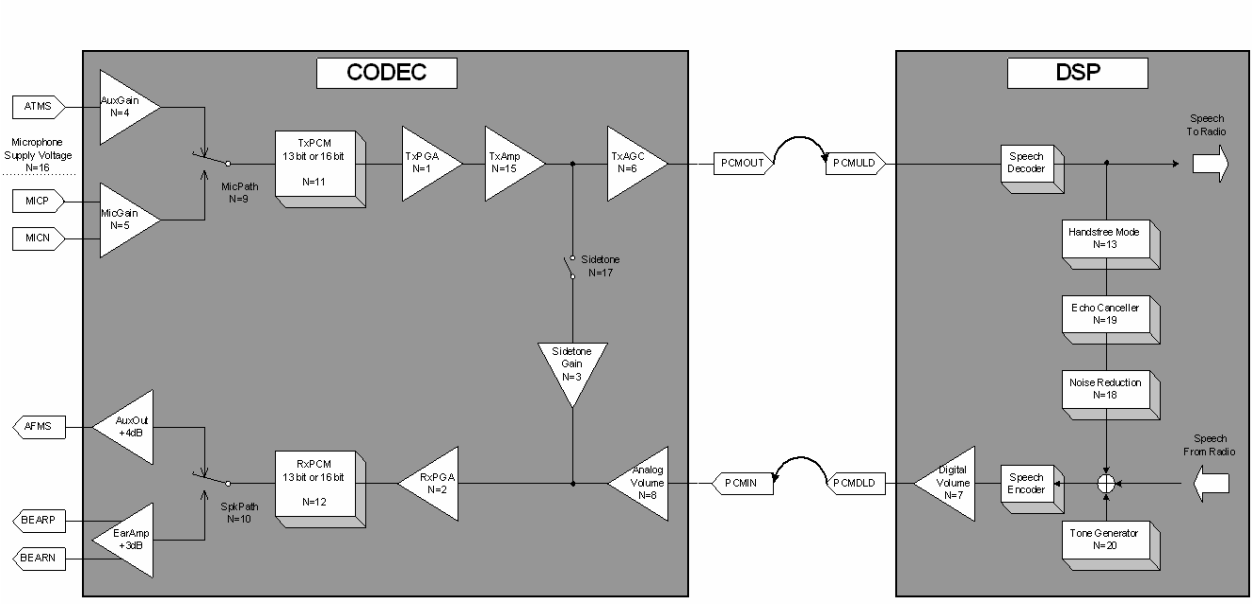

Figure 4.1 Audio diagram of the CODEC

N=	Item	Range	Unit Range	0	1	2	3	4	5	6	7	8	9
1	TxPGA	0-7	-10dB to +7.5dB	-5dB	-2.5db	0db	2.5db	5db	7.5db	-7.5db	-10db		
2	RxPGA	0-7	-10dB to +7.5dB	-5dB	-2.5db	0db	2.5db	5db	7.5db	-7.5db	-10db		
3	Sidetone Gain	0-5	10dB to 25dB	10dB	13db	16db	19db	22db	25db				
4	AuxGain	0-3	Mute to 46dB	Mute	13db	34db	45db						
5	MicGain	0-3	Mute to 46dB	Mute	13db	25db	34db	45db					
6	TxAGC	0-2	0dB to 6dB	0dB	3dB	6db							
7	Digital Volume[1]	0-9	-15dB to 11.25dB	-15dB	-15dB	-11.25dB	-7.5db	-3.75db	0db	3.75db	7.5db	11.25db	
8	Analog Volume[2]	0-9	Mute to 14dB	Mute	-14dB	-10.5dB	-7db	-3.5db	0db	3.5db	7db	10.5db	14dB
9	MicPath	0-3		OFF	Mute	Diff MIC	ATMS						
10	SpkPath	0-3		OFF	Mute	Diff BEAR	AFMS						
11	TxPCM	0-1	13 or 16 bit	13 bit	16 bit								
12	RxPCM	0-1	13 or 16 bit	13 bit	16 bit								
13	HF	0-4		Full Duplex	PHF Half Duplex	Switching Handsfree	Handset	External Carkit					
14	Local Audio	0-3		OFF	Mic only	Spkr only	Mic & Spkr						
15	TxAMP	0-1	-7dB to 0dB	0dB	-7dB								
16	Mic Supply	0-1	2V to 2.5V	2.5V	2.0V								
17	Sidetone On/Off	0-1		OFF	ON								
18	Noise Reduction	0-1		OFF	ON								
19	Echo Cancelling	0-1		OFF	ON								
20	Analog Ring	0-1		OFF	ON								
255	Save Params												

Notes:

Default Values

[1] Previously Volume

[2] Previously Max Volume

Examples

AT*E2EAMS=?
*E2EAMS=(0-21,255)
OK

Current default profile is 0:

AT*E2EAMS?
*E2EAMS: 2,2,3,2,3,2,5,9,3,3,0,1,0,0,0,1,1,1,1,1,1
OK

Sets current profile with these settings:

AT*E2EAMS=0,2,1,2,0,0,2,5,9,2,2,0,1,0,0,0,1,1,0,0,1,1
OK

Sets TxPGA gain to 0dB:

AT*E2EAMS=1,2
OK

Turns analog ringing off:

AT*E2EAMS=20,0
OK

Save current profile to currently loaded profile in non-volatile memory:

AT*E2EAMS=255
OK

4.2 AT*E2APR M2M Audio Profile Manipulation

Description	*Command*	*Possible Responses*
Request operation with audio profile	AT*E2APR= <op>[,<prnum1> [,<prnum2>]]	• ERROR • OK • *E2APR: <TxPGA>,<RxPGA>, <SideToneGain>,<AuxInGain>,< MicInGain>,<TxAGC>, <Volume>,<MaxVolume>, <MicPath>,<SpkPath>, <TxPCM>,<RxPCM>, <HFAlgorithm>,<LocalAudio>, <TxGainLow>,<MicVolt2V>, <SideTone>,<NoiseRed>, <EchoCancel>,<AnalogRing> • OK
Show the current setting	AT*E2APR?	• *E2APR: current <prnum> • ERROR
Show if the command is supported	AT*E2APR=?	• *E2APR: (list of supported <op>s), (list of supported <prnum1>s), (list of supported <prnum2>s) • ERROR

Description:

This command allows the manipulation and storage of the audio “profiles” stored in the MS. The requirement for the 2nd and 3rd parameters depend on the operation being carried out.

Using the command you can:

- Set one of the three audio profiles 0, 1 or 2 as the current profile. This will load the profile's settings from NVM and implement them.
- Read one of the audio profiles. The current settings for the profile number defined will be displayed.
- Copy all parameters from one profile into another.
- Reset any of the profiles. This will reinstate the factory defaults for the profile:
  0 - portable handsfree,
  1 - handset,
  2 - car kit.
- Set a profile as the default profile on next power up.

<op>	*Description*
0	Set profile <prnum1> to set as current
1	Copy profile <prnum1> to <prnum2>
2	Read profile <prnum1> settings
3	Reset profile <prnum1> to factory default
4	Set default profile as <prnum1>. Will store this as defautl

	profile in NVM, and use it as default from next power on

<prnum1>, <prnum2>	*Description*
0	Profile 0 (Factory profile set for portable handsfree) **Default value**
1	Profile 1 (Factory profile set for handset).
2	Profile 2 (Factory profile set for car kit)

Examples

AT*E2APR=?
*E2APR= (0-4),(0-2),(0-2)
OK

Current default profile is profile 0:

AT*E2APR?
*E2APR: 0
OK

Set audio profile now used to profile 1:

AT*E2APR=0,1
OK

Audio profile 1 settings:

AT*E2APR=1,1
*E2APR: 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
OK

Copy audio profile 1 to audio profile 2:

AT*E2APR=2,1,2
OK

Reset audio profile 1 with factory default - this also resets the current audio paths to the new profile as 1 is currently used:

AT*E2APR=3,1
OK

Sets profile number 1 as the default when module is powered on:

AT*E2APR=4,1
OK

4.3 *AT*EALR Ericsson Audio Line Request*

Description	*Command*	*Possible Responses*
Request the audio lines (ATMS,AFMS)	AT*EALR=<mode> [,<activation> [,<aud_status>]]	• *EALR: <mode>, <activation>,<resp> • OK • ERROR
Show the current setting	AT*EALR?	*EALR: <mode>,<activation>,<resp>
Show if the command is supported	AT*EALR=?	*EALR:(list of supported <mode>s, <activation>s and <aud_status>s parameters)

Description:

Included for compatibility. No functionality.

<mode>	*Description*
0	No request for ATMS or AFMS
1	Request ATMS and not AFMS
2	Request AFMS and not ATMS
3	Request ATMS and AFMS

<activation>	*Description*
0	Not direct activated audio accessory (e.g. cordless portable hands free)
1	Direct activated audio accessory (e.g. vehicle hands free)

<aud_status>	*Description*
0	No change of the audio status
1	Audio hand over. Accessory hands over control of both the audio lines and the call to the ME
2	Audio demand. Accessory demands control of both the audio lines and the call

<resp>	*Description*
0	Disable ATMS and AFMS
1	Enable ATMS and disable AFMS
2	Disable ATMS and enable AFMS

3	Enable ATMS and AFMS

4.4 *AT*EAMS Ericsson Audio Mode Selection*

Description	*Command*	*Possible Responses*
Sets the audio mode for the application	AT*EAMS=<internal_voice_alg >[,<noise_reduction> [,<side tone> [,<short_echo_canceling> [,<ATMS_gain> [,<class> [,<ATMS_sensitivity_deviation_ from_class> [,<AFMS_sensitivity_deviation_ from_class>]]]]]]]	• OK • ERROR
Show the current setting	AT*EAMS?	*EAMS:<internal_voice_alg >, <noise_reduction>, <side_tone>, <short_echo_canceling>, <AFMS_gain>,<class>,<ATMS_sensitivity_deviation_from_class>,<AFMS_sensitivity_deviation_from_class>
Show if the command is supported	AT*EAMS=?	*EAMS: (list of supported <internal_voice_alg >s, <noise_reduction>s, <side_tone>s, <short_echo_canceling>s, <AFMS_gain>s>, <class>s, <ATMS_sensitivity_deviation_from_class>s, <AFMS_sensitivity_deviation_from_class>s)

Description:

Included for compatibility. No functionality.

<internal_voice_alg>	*Description*
0	None
1	Semi Duplex
2	Full Duplex (Note! the internal hands free algorithm in the MS contains echo cancelling)

<noise_reduction>	*Description*
0	Off
1	On

<side_tone>	Description
0	Off
1	On

<short_echo_canceling>	Description
0	Off
1	On

<ATMS_gain>	Description
0	Normal (0 dB) (internal voice processing)

<Class>	Description
0	None
1	Low end, class reference Hector
2	Mid End, class reference Scott
3	High End, class reference Hasse

<ATMS_sensitivity_deviation_from_class>, <AFMS_sensitivity_deviation_from_class>	Description
0	0 dB
1	2,5 dB
2	–2,5 dB
3	5,0 dB
4	–5,0 dB

4.5 *AT*EARS Ericsson Audio Ring Signal*

Description	Command	Possible Responses
Request analogue ring signal in the loudspeaker	AT*EARS=<mode>	• OK • ERROR
Show the current setting	AT*EARS?	*EARS: <mode>
Show if the command is supported	AT*EARS=?	*EARS: (list of supported <mode>s)

Description:

Included for compatibility. No functionality.

<mode>	*Description*
0	Disable analogue ring signal
1	Enable analogue ring signal

4.6 *AT*E2PHFB Portable Handsfree Button Sense Enable*

Description	*Command*	*Possible Responses*
Set PHF functionality	AT*E2PHFB=<op>	• ERROR • OK
Show the current setting	AT*E2PHFB?	*E2PHFB: <op>
Show if the command is supported	AT*E2PHFB=?	• *E2PHFB: (list of supported <op>s • ERROR

Description:

This command allows the user to set the functionality for a PHF (portable handsfree) button, as used on simple handsfree equipment. When set to ON, the MS will detect the short circuit of the ATMS and AFMS lines, and interpret this as a PHF button press. This has the effect of answering/hanging up a call without recourse to AT commands.

<op>	*Description*
0	Disable PHF button. **Default value**
1	Enable PHF button

Note! At present this functionality does not work in the software.

4.7 *AT*ELAM Ericsson Local Audio Mode*

Description	*Command*	*Possible Responses*
Set local audio mode	AT*ELAM=<mic> [,<loudspeaker>]	• *ELAM: <mic>, <loudspeaker> • OK • ERROR
Show the current setting	AT*ELAM?	*ELAM: <mic>,<loudspeaker>
Show if the command is supported	AT*ELAM=?	*ELAM: (list of supported <mic>s and <loudspeaker>s parameters)

Description:

Included for compatibility. No functionality.

<mic>	*Description*
0	Off
1	Microphone analogue

<loudspeaker>	*Description*
0	Off
1	Loudspeaker analogue

4.8 *AT*EMIC Ericsson Microphone Mode*

Description	*Command*	*Possible Responses*
Enables/disables the ME microphone	AT*EMIC=<mode>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*EMIC?	• *EMIC: <mode> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EMIC=?	• *EMIC: (list of supported <mode>s) • +CME ERROR: <err> • OK • ERROR

Description:

Included for compatibility. No functionality.

<mode>	*Description*
0	Microphone is disabled (off)
1	Microphone is enabled (on)

4.9 *AT*EMIR Ericsson Music Mute Indication Request*

Description	*Command*	*Possible Responses*
Request for mute indications	AT*EMIR=<mode>	• OK • ERROR
Show the current setting	AT*EMIR?	*EMIR: <mode>,<resp>

Show if the command is supported	AT*EMIR=?	*EMIR: (list of supported <mode>s)

Description:

Included for compatibility. No functionality.

<mode>	*Description*
0	Off, music mute indication result codes will not be sent to the accessory
1	On, music mute indication result codes will be sent to the accessory

<resp>	*Description*
0	Music mute inactive
1	Music mute active

4.10 *AT*ESMA Ericsson Set Message Alert Sound*

Description	*Command*	*Possible Responses*
Sets the answer mode settings in the MS	AT*ESMA=<mode>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ESMA?	• *ESMA: <mode> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESMA=?	• *ESMA: list of supported <mode>s • +CME ERROR: <err> • OK • ERROR

<mode >	*Description*
0	Answer mode is not set to “Any key”, or “Auto” (off)
1	Any Key mode on
2	Auto mode on

4.11 *ATM Monitor Speaker Control*

Description	*Command*	*Possible Responses*

Set monitor speaker control	ATM[=][<speaker>]	• OK • ERROR
Show the current setting	ATM?	M: <speaker>
Show if the command is supported	ATM=?	M: (list of supported <speaker>s)

Description:

Define the activity of the speaker. This command is ignored by the modem and is only included for compatibility.

<speaker>	*Description*
0	Off during the entire call. **Default value**
1-3	Different “on” modes

4.12 *AT*ERIL Ericsson Ring Level Set*

Description	*Command*	*Possible Responses*
Sets ring volume for the ring signals used for incoming voice (L1 and L2), fax and data calls	AT*ERIL=<volume>[,<call type> [,<place>]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ERIL?	• *ERIL: <volume1>[,<call type1> [,<place1> [<CR><LF>…*ERIL: <volume n>[, <call type n> [,<place n>]]]]] • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ERIL=?	• *ERIL: (list of supported <volume>s)[,(list of supported <call type>s) [,(list of supported <place>s)]] • +CME ERROR: <err> • OK • ERROR

Description:

Used to set the volume for the ring signals used for incoming voice, Line 1, Line 2, fax and data calls. The parameter <place> controls the ring level set for different types of modes. The signal volume is specified as “step”, with an increasing volume for each signal, or as a selected level.

Line 1 is the default for <call type> if the parameter is not given.

<volume>	*Description*
0	Off
1-6	Volume setting, not increasing ring
129-134	Volume setting, increasing ring

<calltype>	*Description*
1	Line 1
2	Line 2
3	Fax
4	Data
5	Alarm. `Not supported`

<place>	*Description*
0	Hand held
1	Car mounted

4.13 *AT*ERIN Ericsson Ring Set*

Description	*Command*	*Possible Responses*
Sets ring type for incoming voice (L1 and L2), fax and data calls and alarm	AT*ERIN= <sound type>, [<call type>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ERIN?	• *ERIN: <sound type1>,<call type1>[<CR><LF>… *ERIN: <sound type n>,<call type n>] • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ERIN=?	• *ERIN: list of supported <sound type>s, list of supported <call type>s • +CME ERROR: <err> • OK • ERROR

Description:

Used to set sound for incoming voice, line L1 and L2, fax, data calls and alarm. For each of the incoming call types and alarm: voice on line 1, voice on line 2, fax calls and data calls and alarm a sound type is selected.

The type of sound is either a ring signal, selected from a predefined set, a melody, selected from a predefined set, or an own melody, selected from a set specified by the user.

Line 1 is the default for <call type> if the parameter is not given.

<calltype>	*Description*
1	Line 1
2	Line 2
3	Fax
4	Data
5	Alarm

<soundtype>	*Description*
0	Off. **Not supported**
1	Low ring signal
2	Medium ring signal
3	High ring signal
4	Mixed ring signal
5	Beep. **Not supported**
6	Alarm. **Not supported**
7	Calendar Tone. **Not supported**
8	Calendar Click. **Not supported**
9-10	Reserved. **Not supported**
11-20	Melody 1. Melody 10 reserved for preset melodies
21-30	Reserved. **Not supported**
31-38	Own melodies 1-8
39-5	Reserved for own melodies. **Not supported**

4.14 *AT*ERIP Ericsson Ring Signal Playback Command*

Description	*Command*	*Possible Responses*
Plays the selected sound type at specified volume level	AT*ERIP = <volume>,<sound type>	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ERIP=?	• *ERIP: (list of supported <volume>s),(list of supported <sound type>s) • OK • ERROR

Description:

Used to play one of the sound types which are available as ring signals/ message signals on the module. The signal volume may not be chosen as “step”; with an increasing volume for each signal. If value 1 is chosen for parameter <volume>, nothing should happen. Signal volume may be chosen as a selected level.

<volume>	*Description*
0	Off
1	Step. Not supported
2-n	Volume settings

Refer to the AT*ERIN command for the <sound type> parameter.

5 Data - CSD/HSCSD

Note! Since the module does not support V42bis compression the following commands have not been implemented:

- AT+DS
- AT+DR

5.1 *AT+CBST Select Bearer Service Type*

Description	*Command*	*Possible Responses*
Select bearer service type	AT+CBST=[<speed>, [<name>,[<ce>]]]	• OK • ERROR
Show the current setting	AT+CBST?	• +CBST: <speed>,<name>, <ce> • OK • ERROR
Show if the command is supported	AT+CBST=?	• +CBST: (list of supported <speed>s,list of supported <name>s, list of supported <ce>s) • OK • ERROR

Description:

Selects the bearer service <name> with data rate <speed>, and the connection element <ce> to be used when data calls are originated. Values may also be used during mobile terminated data call setup, especially in the case of single numbering scheme calls.
Test command returns values supported by the TA as compound values.

<speed>	*Description*
0	Auto selection of baud rate
4	2400 bps V.22bis
6	4800 bps V.32
7	9600 bps V.32
12	9600 bps V.34
15	19200 bps V.34

68	2400 bps V.110 (ISDN)
70	4800 bps V.110 (ISDN)
71	9600 bps V.110 (ISDN)
75	14400 bps V.110 (ISDN)
79	19200 bps V.110 (ISDN)
80	28800 bps V.110 (ISDN)
81	38400 bps V.110 (ISDN)
82	48000 bps V.110 (ISDN)
83	56000 bps V.110 (ISDN)

<name>	*Description*
0	Asynchronous connection (UDI or 3.1 kHz modem)

<ce>	*Description*
1	Non transparent

5.2 *AT+CRLP Radio Link Protocol*

Description	*Command*	*Possible Responses*
Set radio link protocol	AT+CRLP=[<iws>[,<mws>[,<T1>[,<N2>[,<ver>[, <T4>]]]]]]	• OK • ERROR
Show the current setting	AT+CRLP?	• +CRLP: <iws>,<mws>,<T1>,<N2>[,<ver1>[,<T4>]][<CR><LF> • +CRLP: <iws>,<mws>,<T1>,<N2>[,<ver2>[,<T4>]][...]] • OK • ERROR
Show if the command is supported	AT+CRLP=?	• +CRLP: (list of supported <iws>s), (list of supported <mws>s), (list of supported <T1>s), (list of supported<N2>s)[,<ver1>[,(list of supported <T4>s)]][<CR><LF>+CRLP: (list of supported <iws>s), (list of supported <mws>s), (list of supported <T1>s), (list of supported <N2>s)[,<ver2>[,(list of supported <T4>s)]][...]] • OK • ERROR

Description:

Radio link protocol (RLP) parameters used when non-transparent data calls are originated may be altered with this command. Available command subparameters depend on the RLP versions implemented by the device (e.g. <ver> may not be available if device supports only versions 0 and 1).

Read command returns current settings for each supported RLP version <verx>. Only RLP parameters applicable to the corresponding <verx> are returned.

Test command returns values supported by the TA as a compound value. If ME/TA supports several RLP versions <verx>, the RLP parameter value ranges for each <verx> are returned in a separate line.

<iws>	*Description*
120 0 - 496	IWF to MS window size

<mws>	*Description*
120 0 - 496	MS to IWF window size

<T1>	*Description*
48 38 - 100	Acknowledgment timer T1 (*10 ms)

<N2>	*Description*
6 0 - 255	Re-transmission attempts N2

<T4>	*Description*
5 3 - 255	Re-sequencing period T4 (*10 ms)

<ver>	*Description*
Integer	RLP version. When version indication is not present, <ver>=0 is assumed

Example! AT+CRLP?
+CRLP: 61,61,48,6,0
+CRLP: 120,120,48,6,2,3

OK

6 Data - GPRS

6.1 *AT+CGACT PDP Context Activate or Deactivate*

Description	*Command*	*Possible Responses*
Activate or deactivate the specified PDP context(s)	+CGACT=[<state> [,<cid>[,<cid>[,…]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	+CGACT?	• +CGACT: <cid>, <state>[<CR><LF> +CGACT: <cid>, <state>[...]] • OK • ERROR
Show if the command is supported	+CGACT=?	• +CGACT: (list of supported <state>s) • OK • ERROR

Description:

Used to activate or deactivate the specified PDP context(s).

After the command has completed, the MS remains in V.250 command state. If the MS is already in the requested state, the command is ignored and OK is returned. If the requested state cannot be achieved, ERROR or +CME: ERROR is returned. If the MS is not attached to the GPRS service when the activation form of the command is executed, the MS first performs a GPRS attach and then attempts to activate the specific contexts.

If no <cid>s are specified the activation form of the command activates all defined contexts.

If no <cid>s are specified the deactivation form of the command deactivates all active contexts.

<state>	*Description*
0	PDP context activation deactivated
1	PDP context activation activated

<cid>	Description
Integer type	A numeric parameter which specifies a specific PDP context definition

6.2 AT+CGATT GPRS Attach or Detach

Description	Command	Possible Responses
Attach or detach MS to the GPRS/packet domain/packet domain service	+CGATT=[<state>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	+CGATT?	• +CGATT: <state> • OK • ERROR
Show if the command is supported	+CGATT=?	• +CGATT: (list of supported <state>s) • OK • ERROR

Description:

Used to attach the MS to, or detach the MS from, the GPRS/packet domain service. After the command has completed, the MS remains in V.250 command state. If the MS is already in the requested state, the command is ignored and the OK response is returned. If the requested state cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses (enabled by the +CMEE command) are listed under “+CME ERROR (Mobile Equipment Error Code)”, page 13.

Any active PDP contexts will be automatically deactivated when the attachment state changes to detached.

Note! This command has the characteristics of both the V.250 action and parameter commands. Hence it has the read form in addition to the execution/set and test forms.

Note! The unit software is automatically hard coded to attach to a GPRS network therefore entering this command as part of the initialization sequence is not required.

<state>	Description
0	Detached
1	Attached

6.3 *AT+CGDATA Enter Data State*

Description	*Command*	*Possible Responses*
Establish GPRS/packet domain connection	+CGDATA=[<L2p>,[cid[,cid>[,…]]]]	• CONNECT • ERROR • OK • ERROR
Show if the command is supported	+CGDATA=?	• +CGDATA: (list of supported <L2P>s) • OK • ERROR

Description:

Causes the MS to perform whatever actions are necessary to establish communication between the TE and the network using one or more GPRS/packet domain PDP types. This may include performing a GPRS/packet domain attach and one or more PDP context activations.

<L2P>	*Description*
PPP	Point-to-point protocol for a PDP such as IP

6.4 *AT+CGDCONT Define PDP Context*

Description	*Command*	*Possible Responses*
Select PDP context parameters	+CGDCONT=[<cid>[,<PDP_type>[,<APN>[,<PDP_addr>[,<pd1>[,…[,pdN]]]]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	+CGDCONT?	• +CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,[,<pd1>[,…[,pdN]]] [<CR><LF>+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,[,<pd1>[,…[,pdN]]] [...]] • OK • ERROR
Show if the command is supported	+CGDCONT=?	• +CGDCONT: (range of supported <cid>s),<PDP_type>,,,[,(list of supported <pd1>s)[,…[,(list of supported <pdN>s)]]] [<CR><LF>+CGDCONT: (range of supported <cid>s),<PDP_type>,,,[,(list of supported <pd1>s)[,…[,(list of supported <pdN>s)]]] [...]]

	• OK • ERROR

Description:

Specifies PDP context parameter values for a PDP context identified by the (local) context identification parameter, <cid>. When entered in the data is automatically saved to flash.

<cid>	*Description*
Integer type	(PDP Context Identifier) a numeric parameter which specifies a particular PDP context definition. The parameter is local to the TE-MS interface and is used in other PDP context-related commands. The range of permitted values (minimum value = 1) is returned by the test form of the command
1-10	Supported values. Ericsson specific

<PDP_type>	*Description*
IP	Internet Protocol (IETF STD 5)

<APN>	*Description*
String type	(Access Point Name) a string parameter which is a logical name that is used to select the GGSN or the external packet data network. If the value is null or omitted, then the subscription value will be requested

<PDP_address>	*Description*
String type	A string parameter that identifies the MS in the address space applicable to the PDP. If the value is null or omitted, then a value may be provided by the TE during the PDP startup procedure or, failing that, a dynamic address will be requested

<pdN>	*Description*
String type	Zero to N string parameters whose meanings are specific to the <PDP_type>

6.5 *AT+CGEREP GPRS Event Reporting*

Description	*Command*	*Possible Responses*
Set command	+CGEREP=[<mode> [,<bfr>]]	• +CME ERROR: <err> • OK

		• ERROR
Show the current setting	+CGEREP?	• +CGEREP: <mode>,<bfr> • OK • ERROR
Show if the command is supported	+CGEREP=?	• +CGEREP: (list of supported <mode>s),(list of supported <bfr>s) • OK • ERROR

Description:

Enables or disables the sending of unsolicited result codes, +CGEV: XXX from MS to TE in the case of certain events occurring in the GPRS/packet domain MS or the network.

<mode>	*Description*
0	Buffer unsolicited result codes in the MS. No codes are forwarded to the TE
1	Discard unsolicited result codes when MS-TE link is reserved; otherwise forward them directly to the TE

<bfr>	*Description*
0	MS buffer of unsolicited result codes defined within this command is cleared when <mode> 1 or 2 is entered

6.6 *AT+CGPADDR Show PDP Address*

Description	*Command*	*Possible Responses*
Show PDP addresses for specified CIDs	+CGPADDR=[<cid> [,<cid> [,…]]]	• +CGPADDR: <cid>,<PDP_addr> [<CR><LF>+CGPADDR: <cid>,<PDP_addr> [...]] • OK • ERROR
Show if the command is supported	+CGPADDR=?	• +CGPADDR: (list of defined <cid>s) • OK • ERROR

Description:

Returns a list of PDP addresses for the specified context identifiers. The test command returns a list of defined <cid>s.

<cid>	*Description*
Integer type	Parameter which specifies a particular PDP context definition (see +CGDCONT command). If no <cid> is specified, the addresses for all defined contexts are returned

<PDP_address>	*Description*
String type	A string that identifies the MS in the address space applicable to the PDP. The address may be static or dynamic. For a static address, it will be the one set by the +CGDCONT command when the context was defined. For a dynamic address it will be the one assigned during the last PDP context activation that used the context definition referred to by <cid>. <PDP_address> is omitted if none is available

6.7 *AT+CGQMIN Quality of Service Profile (Minimum Acceptable)*

Description	*Command*	*Possible Responses*
Set minimum acceptable profile	+CGQMIN=[<cid> [,<precedence> [,<delay> [,<reliability> [,<peak> [,<mean>]]]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	+CGQMIN?	• +CGQMIN: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean>[<CR><LF>+CGQMIN: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean>[…]] • OK • ERROR
Show if the command is supported	+CGQMIN=?	• +CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s)[<CR><LF>+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s)[…]] • OK • ERROR

Description:

Allows the TE to specify a minimum acceptable profile which is checked by the MS against the negotiated profile returned in the Activate PDP Context Accept message.

The set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. Since this is the same parameter that is used in the +CGDCONT command, the +CGQMIN command is effectively an extension to the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQMIN=<cid> causes the minimum acceptable profile for context number <cid> to become undefined. In this case no check is made against the negotiated profile.

<cid>	*Description*
Integer type	Parameter which specifies a particular PDP context definition

<precedence>	*Description*
0	Subscribed (from network) value used
1	High priority
2	Normal priority
3	Low priority

<delay>	*Description*
0	Subscribed (from network) value used
1-4	Delay class

<reliability>	*Description*
0	Subscribed (from network) value used
1-5	Reliability class

<peak>	*Description*
0	Subscribed (from network) value used
1	Up to 1 000 (8 kbits/s)
2	Up to 2 000 (16 kbits/s)

3	Up to 4 000 (32 kbits/s)
4	Up to 8 000 (64 kbits/s)
5	Up to 16 000 (128 kbits/s)
6	Up to 32 000 (256 kbits/s)
7	Up to 64 000 (512 kbits/s)
8	Up to 128 000 (1 024 kbits/s)
9	Up to 256 000 (2 048 kbits/s)

<mean>	*Description*
0	Subscribed (from network) value used
1	Best effort
2	100 (~0.22 bits/s)
3	200 (~0.44 bits/s)
4	500 (~1.11 bits/s)
5	1000 (~2.2 bits/s)
6	2 000 (~4.4 bits/s)
7	5 000 (~11.1 bits/s)
8	10 000 (~22 bits/s)
9	20 000 (~44 bits/s)
10	50 000 (~111 bits/s)
11	100 000 (~0.22 kbits/s)
12	200 000 (~0.44 kbits/s)
13	500 000 (~1.11 kbits/s)
14	1 000 000 (~2.2 kbits/s)
15	2 000 000 (~4.4 kbits/s)
16	5 000 000 (~11.1 kbits/s)
17	10 000 000 (~22 kbits/s)
18	20 000 000 (~44 kbits/s)
31	50 000 000 (~111 kbits/s)

6.8 *AT+CGQREQ Quality of Service Profile (Requested)*

Description	*Command*	*Possible Responses*
Set quality of	+CGQREQ=[<cid>	• +CME ERROR: <err>

service profile	[,<precedence> [,<delay> [,<reliability> [,<peak> [,<mean>]]]]]	• OK • ERROR
Show the current setting	+CGQREQ?	• +CGQREQ: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean>[<CR><LF>+CGQREQ: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean>[…]] • OK • ERROR
Show if the command is supported	+CGQREQ=?	• +CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s)[…]] • OK • ERROR

Description:

Allows the TE to specify a quality of service profile that is used when the MS sends an activate PDP context request message to the network.

The set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. Since this is the same parameter that is used in the +CGDCONT command, the +CGQREQ command is effectively an extension to the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

A special form of the set command, +CGQREQ= <cid> causes the requested profile for context number <cid> to become undefined.

<cid>	*Description*
Integer type	Parameter which specifies a particular PDP context definition

<precedence>	*Description*
0	Subscribed (from network) value used
1	High priority
2	Normal priority

3	Low priority

<delay>	*Description*
0	Subscribed (from network) value used
1-4	Delay class

<reliability>	*Description*
0	Subscribed (from network) value used
1-5	Reliability class

<peak>	*Description*
0	Subscribed (from network) value used
1	Up to 1 000 (8 kbits/s)
2	Up to 2 000 (16 kbits/s)
3	Up to 4 000 (32 kbits/s)
4	Up to 8 000 (64 kbits/s)
5	Up to 16 000 (128 kbits/s)
6	Up to 32 000 (256 kbits/s)
7	Up to 64 000 (512 kbits/s)
8	Up to 128 000 (1 024 kbits/s)
9	Up to 256 000 (2 048 kbits/s)

<mean>	*Description*
0	Subscribed (from network) value used
1	Best effort
2	100 (~0.22 bits/s)
3	200 (~0.44 bits/s)
4	500 (~1.11 bits/s)
5	1 000 (~2.2 bits/s)
6	2 000 (~4.4 bits/s)
7	5 000 (~11.1 bits/s)
8	10 000 (~22 bits/s)

9	20 000 (~44 bits/s)
10	50 000 (~111 bits/s)
11	100 000 (~0.22 kbits/s)
12	200 000 (~0.44 kbits/s)
13	500 000 (~1.11 kbits/s)
14	1 000 000 (~2.2 kbits/s)
15	2 000 000 (~4.4 kbits/s)
16	5 000 000 (~11.1 kbits/s)
17	10 000 000 (~22 kbits/s)
18	20 000 000 (~44 kbits/s)
31	50 000 000 (~111 kbits/s)

6.9 *AT+CGREG GPRS Network Registration Status*

Description	*Command*	*Possible Responses*
Set command	AT+CGREG=[<n>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CGREG?	• +CGREG: <n>,<stat>[,<lac>, <ci>] • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CGREG=?	• +CGREG: (list of supported <n>s) • OK • ERROR

Description:

Controls the presentation of an unsolicited result code +CGREG: <stat> when <n>=1 and there is a change in the GPRS/packet domain network registration status of the MS, or code +CGREG: <stat>[,<lac>,<ci>] when <n>=2 and there is a change of the network cell.

Note! If the GPRS/Packet Domain MS also supports circuit mode services, the +CGREG command and +CGREG: result code apply to the registration status and location information for those services.

<n>	*Description*
0	Disable network registration unsolicited result code
1	Enable network registration unsolicited result code
2	Enable network registration and location information unsolicited result code

<stat>	*Description*
0	Not registered, MS is not searching for a new operator to register with
1	Registered, home network
2	Not registered, but MS is searching for a new operator to register with
3	Registration denied
4	Unknown
5	Registered, roaming

<lac>	*Description*
String type	Two byte location area code in hexadecimal format

<ci>	*Description*
String type	Two byte cell ID in hexadecimal format

Example!

```
AT+CGREG?
+CGREG: 0,3

OK
```

6.10 *AT+CGSMS Select Service for MO SMS Messages*

Description	*Command*	*Possible Responses*
Set service or service preference	+CGSMS=[<service>]	• OK • ERROR
Show the current setting	+CGSMS?	• +CGSMS: <service> • OK • ERROR
Show if the command is supported	+CGSMS=?	• +CGSMS: (list of available <service>s) • OK

	• ERROR

Description:

Used to specify the service or service preference that the MS will use to send MO SMS messages. The read command returns the currently selected service or service preference.

<services>	*Description*
2	GPRS/packet domain preferred (use circuit switched if GPRS/packet domain not available)
3	Circuit switched preferred (use GPRS/packet domain if circuit switched not available)

6.11 *AT*E2GDV GPRS Data Volume*

Description	*Command*	*Possible Responses*
Report Connection Data Volume	AT*E2GDV=[<option>]	• *E2GDV: <bytes> • OK • ERROR
Show if the command is supported	AT*E2GDV=?	• *E2GDV: (list of supported <option>s) • OK • ERROR

The command reports the amount of data the last GPRS session received and transmitted, or it will report the total amount of data received and transmitted during all past GPRS sessions. Also there is an option to clear the latter of these two counters. The behaviour of the command is selected with the <option> parameter as described in the table below.

<option>	*Description*
0	Report the amount data the last GPRS session transmitted and received, in bytes.
1	Report the accumulated amount of data of all previous GPRS sessions, since the last execution of *E2GDV=2, in bytes.
2	Resets the data counters to 0.

<bytes>	*Description*
0-4294967295	Bytes of data transferred. <bytes> will wrap around back to 0 after 4294967295 (or ~4GB)

Note! This command only provides an accurate count when used when used with an external TCP/IP stack. When used with the internal stack certain data is not counted which may be charged for i.e. IP address negotiation. As a result the figure produced by the unit can only be used as a guide, please talk to your service provider for details.

7 Data - TCP/IP

For more information on using these commands please refer to the application note 'Using AT commands to control on SEM modules'

7.1 *AT*E2IPA M2M IP Activate*

Description	*Command*	*Possible Responses*
Request Activation/deactivation of IP	AT*E2IPA=<Activate>,<cid>	• ERROR·OK • E2IPA: <ErrNum> • ERROR
Displays current IP activation Status	AT*E2IPA?	• *E2IPA: <Active> OK • ERROR
Shows if the command is supported	AT*E2IPA=?	• *E2IPA: (list of supported <Activate>s), (list of supported < cid >s) OK • ERROR

Description:

This command allows the Activation of the IP Session on the module. Once activated with a previously stored context (see AT+CGDCONT & AT*ENAD) IP connections can be made, and the module will negotiat itself an IP Address.

Abortability:

This command may not be aborted

Defined values:

<Activate>	*Description*
0	Deactivate IP Session
1	Activate IP Session

<cid>	*Description*
Integer	Value range 0-10 for a reference to a PDP context identifier previously defined with AT+CGDCONT

<ErrNum>	*Description*
1	PDP Invalid Context
2	PDP Account Invalid
3	PDP Shutdown Failure
8	PDP Setup Cancelled
9	PDP Too Many Active Accounts
10	PDP Conflict with Higher Priority Account
11	PDP Too Many Active Users
12	PDP Non Existant Account
13	PDP Stop at User Request
14	PDP Authentication failed
15	PDP Bearer Failed Connect
16	PDP Remote Server Busy
17	PDP Remote Server Refused
18	PDP Bearer Busy
19	PDP Line Busy
20	PDP Unknown Error
255	PDP Invalid Parameter

<Active>	*Description*
0	IP Session Inactive
1	IP Session Active

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Example!
```
AT*E2IPA=?
 *E2IPA= (0-1),(0-10)

OK
```

AT*E2IPA?
*E2IPA: 0 (IP Session Inactive)

OK

AT*E2IPA=1,1

OK (Activate PDP Context with id == 1)

AT*E2IPA?
*E2IPA: 1

OK (IP Session Active)

AT*E2IPA=1,2 (Try activating an invalid context)
*E2IPA: 002 (Error code denotes problem)

ERROR

7.2 *AT*E2IPO M2M IP cOnnect/Open*

Description	*Command*	*Possible Responses*
Request an IP Connection	AT*E2IPO=<IPType>, <IPAddr>,<IPPort>	• ERROR • CONNECT • *E2IPO: <ErrNum> ERROR
Displays current IP Connection Status	AT*E2IPO?	• *E2IPO: <Open> OK • ERROR
Shows if the command is supported	AT*E2IPO=?	• *E2IPO: (list of supported <IPType>s), (list of supported <IPAddr>s), (list of supported <IPPort>s) OK • ERROR

Description:

This command allows the unit to connect to another IP address and enter on line data mode thereby allowing data to be transferred to between the two IP addresses transparently. The command allows either TCP or UDP connections.

If an error occurs during the negotiation with the IP address the unit will return an ERROR with an associated error number, otherwise it will return CONNECT. If at any point the unit deems that the connection has been lost (see AT*E2IPS command)or it receives a disconnect message then the NO CARRIER response will be returned.

On line command mode can be entered by either dropping DTR or the +++at<cr> escape sequence, this does however need to be turned on (see AT*E2IPS command for more details).

Abortability:

This command may not be aborted. (A connection can take upto 75 seconds to time out due to the unit having to wait for the packets that it has sent to time out, this is hard coded and cannot be adjusted at present)

Defined values:

<IPType>	*Description*
0	UDP (Connectionless)
1	TCP (Connection oriented)

<IPAddr>	*Description*
string	String type of the form “nnn.nnn.nnn.nnn” where n is a digit from 0-9. Standard IPv4 format for IP Address to connect to.

<IPPort>	*Description*
Integer	Range 0- 65535. Decimal representation of Port number to connect to (e.g. HTTP port is 80).

<ErrNum>	*Description*
1	No Connection
2	Connecting
3	Connected
4	Connection Busy
255	Other Error

<Open>	*Description*
0	IP connection Closed
1	IP connection Open

Unsolicited Result codes:

NO_CARRIER, OK

Execution Time:

Executed immediately, not time critical.

Example!

AT*E2IPO?
*E2IPA: 0 (IP Connection closed)

OK

AT*E2IPO=1,”122.123.201.211”,80

CONNECT (TCP Connection successful with specified host – now in online Data Mode (DCDasserted))

<<Data Transfer>>

NO_CARRIER (Connection closed remotely – back into off-line command mode (DCD Deasserted))

7.3 *AT*E2IPC M2M IP Close Connection*

Description	*Command*	*Possible Responses*
Request an IP Connection Close	AT*E2IPC	• ERROR • OK • *E2IPC: <ErrNum> ERROR
Shows if the command is supported	AT*E2IPC=?	• OK • ERROR

Description:

This command allows the closure of a currently open IP Connection. This command can only be called in on-line command mode during a currently active IP connection. If successful the connection will be closed, and it will not be possible to re-enter online data mode until another connection is established.

Abortability:

This command may not be aborted

Defined values:

<ErrNum>	*Description*
1	No Connection
2	Connecting
3	Connected
4	Connection Busy
255	Other Error

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Note! It is recommended that if there is a problem at any time with the TCP/IP connection and the application is trying to re establish the link that this command be used to ensure that all of the internal module buffers have been cleared down.

7.4 AT*E2IPI M2M IP Info

Description	*Command*	*Possible Responses*
Request IP Information	AT*E2IPI=<InfoType>	• ERROR • *E2IPI: <IPAddr> OK
Shows if the command is supported	AT*E2IPI=?	• *E2IPI: list of supported <InfoType>s OK· • ERROR

Description:

This command allows information about the current IP Status of the module to be reported. The command will only succeed when an IP Session is Active (see AT*E2IPA).

Abortability:

This command may not be aborted.

Defined values:

<InfoType>	*Description*
0	IP Address of Module
1	IP Address of Primary DNS Server
2	IP Address of Secondary DNS Server

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Example!
```
AT*E2IPI=0
*E2IPI: 120.211.22.102

OK
```

7.5 *AT*E2IPRH M2M IP Resolve Host*

Description	*Command*	*Possible Responses*
Request an IP Resolve Host	AT*E2IPRH=<URL>	• ERROR • *E2IPRH: <IPAddr> OK
Shows if the command is supported	AT*E2IPRH=?	• OK • ERROR

Description:

This command allows an IP lookup on a given URL string denoting an IP Host. The command will only succeed when an IP Session is Active (see AT*E2IPA) and if the string is 32 characters or less.

Abortability:

This command may not be aborted. Be aware this function can take up to 125-140 seconds to return if the URL does not exist.

Defined values:

<URL>	*Description*
String	URL of required server for which an IP lookup is required. The URL is encapsulated in quotes (“”) and cannot exceed 32 characters.

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Example! AT*E2IPRH=”www.google.co.uk”
*E2IPRH: 123.123.123.123

OK

7.6 *AT*E2IPE M2M IP Last Error*

Description	*Command*	*Possible Responses*
Request a Error on Last IP Connection	AT*E2IPE or AT*E2IPE?	• ERROR • *E2IPE: <ErrType> OK
Shows if the command is supported	AT*E2IPE=?	• OK • ERROR

Description:

This command responds with the Error code for the last IP Connection. This is useful to determine the cause of the last IP Connection release – whether it was meant or due to an error.

Abortability:

This command may not be aborted.

Defined values:

<ErrType>	*Description*
0	IP OK - No Error
1	IP Host not found
253	IP Error Receiving IP Data
253	IP Error Max number of retries
254	IP Error GPRS Connection Lost
255	IP Error General Failure

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Example! AT*E2IPE?

*E2IPE: 0 No Error.

OK

7.7 AT*E2IPS M2M IP Setup IP Parameters

Description	*Command*	*Possible Responses*
Request Setup of IP Parameters for next session	AT*E2IPS=<RetryTm>,<NmRetry>,<WaitTm>,<SendSz>,<esc>	• ERROR • OK
Read Current status of Parameters	AT*E2IPS?	• *E2IPS: <RetryTm>,<NmRetry>,<WaitTm>,<SendSz>,<esc> OK
Shows if the command is supported	AT*E2IPS=?	• *E2IPS: list of supported <RetryTm>, list of supported <NmRetry>, list of supported <WaitTm>, list of supported <SendSz>, list of supported <esc>OK • ERROR

Description:

This command can be used to modify the way in which the Data received by the module is handled with respect to transmitting it across TCP/UDP. When Data is sent to the Module in online data mode, the data is internally buffered until there is an amount of data that makes an IP packet send viable. This

packet size is defined by <SendSz>. If <SendSz> is not received, and no data is received for <WaitTm>*100ms then the data will be send as a packet anyway – regardless of the packet size. Retransmit intervals are controlled internally but will do this for <NmRetry> times. If the data is still not sent by this time, the socket/session will be closed and revert to offline command mode with a NO CARRIER response.

The final parameter <esc> controls whether the module will look for an escape sequence in on line data mode, this enables applications to use 3 wire RS232 communication rather than having to implement DTR. By default this is off.

Abortability:

This command may not be aborted

Defined values

< RetryTm >	*Description*
1 - 10	Number of seconds to wait for retry sending an IP packet when it can't be sent immediately. Default = 2 seconds (Not supported)

< NmRetry >	*Description*
3 - 8	Number of retries to be made before the socket is closed due to excessive delay. Default = 8 See application note 'Using AT commands to control the TCP/IP stack in SEM modules' for more information on the retry algorithm employed in the module stack.

< WaitTm >	*Description*
1 - 10	Number of 100ms intervals to wait for incoming data before sending the packet to IP. Default = 2 (200ms) (Not supported)

< SendSz >	*Description*
255 - 1020	Size in bytes of the data chunk to be received before sending to IP. Default 1020 bytes. Note this is only applicable when using TCP connections, when using UDP all packets will be 255 bytes in lenth.

< esc >	Description
0	Turn the use of the escape sequence during a TCP/IP session off (Default).

1	Turn the use of the escape sequence during a TCP/IP session on.

Unsolicited Result codes:

None

Execution Time:

Executed immediately, not time critical.

Example! AT*E2IPS?

*E2IPS: 2,10,2,1020,0 Defaults

OK

AT*E2IPS = 2,4,2,500,0 //Set number of retires to 4, TCP packet size to 500bytes and turn of the escape sequence.

OK

AT*E2IPS = ,,, Set to Defaults

OK

7.8 *AT*E2IPL IP listen (server)*

Description	Command	Possible Responses
Set the unit to behave as a server	AT*E2IPL=<sck>,<IPtype>,<IPport>,<to>	• Listening on port <IPport> • ERROR
Test if the command is supported	AT*E2IPL=?	• *E2IPL: list of supported <sck>, list of supported <IPtype>, list of supported <IPport>, list of supported <to> • +CME ERROR <err>

Description

The IP listen function is used to allow other IP address to connect to it. The command will only succeed when an IP Session is Active (see AT*E2IPA).

Note! The use of this command is defined in the application note 'Using AT commands to control on SEM modules'.

Abortability

The command is abortable.

Defined values:

Table 1. <sck> : parameter

<sck>	*Description*
0	Reference number of the socket to be connected to. The unit currently only supports a single socket.

Table2. <IPtype> : parameter

<IPtype>	*Description*
0	UDP (connectionless)
1	TCP (connection oriented)

Table 3. <IPport> : parameter

<IPport>	*Description*
0-65535	Port to listen on

Table 4. <to> : parameter

<to>	*Description*
0	When listen entered do not enter command mode unless aborted
1 - 255	Time out in seconds

7.9 *AT*ENAD Ericsson Internet Account Define*

Description	*Command*	*Possible Responses*
Define an internet account	AT*ENAD=[<index>][,<name>,<userid>,<password>,<bearer>,(bearer_settings)]If <bearer>=1(bearer_settings):=<pref_serv>,<pap_chap>	• *ENAD:<index>[,<cid>] • +CME ERROR <err>
Read the current settings	AT*ENAD?	• *ENAD:list of <index>s with corresponding <name>, <userid>,,<bearer> followed by the list of bearer dependent parameters • If <bearer>=1 (bearer_settings):=<pref_serv>,<pap_chap>,<cid>,<lock_state> • +CME ERROR <err>
Test if the command is supported	AT*ENAD=?	• *ENAD:list of supported <index>s,max length of <name>,max length of <userid>,max length of

	<password>,(1),list of supported <pref_serv>s,list of supported <pap_chap>s,list of supported <lock_state>s • +CME ERROR <err>

Description:

This command is used for defining an Internet Account.

Abortability:

Not abortable

Defined values:

Table 1. <index>: parameter

<index>	*Description*
integer 1-10	Each Internet Account is given a unique index

When a data account is created a corresponding ENAD account is created to complement it. If the account is not changed then no username or password is used during the negotiation for an IP address (see AT*E2IPA command).

When accounts are created data account 1 relates across to ENAD account 1, these numbers always reference each other.

Table 2. <name>: parameter

<name>	*Description*
string (max 20 16-bit characters)	Each Internet Account has a (“friendly”) name

Table 3. <userid>: parameter

<userid>	*Description*
string (max 64 8-bit characters)	The user id to be used when setting up the connection.

Table 4. <passwd>: parameter

<passwd>	*Description*
string (max 64 8-bit characters)	The password to be used when setting up the connection

Note! If the <passwd> parameter is left blank this shall be interpreted as a request for the <userid> and <passwd> parameters to be set dynamically.

Note! For security reasons the read command shall not return the value of the <passwd> parameter. The empty place of the <passwd> parameter shall be indicated by two consecutive commas.

Note! For practical information on how to use this command such as using usernames and passwords with @ in refer to the application note ‘Using AT commands to control the TCP/IP stack’.

Table 5. <bearer>: parameter

<bearer>	*Description*
0	Circuit Switched dial-up. **Not Supported**
1	Packet Domain service
2	Bluetooth **Not supported**
3	SMS **Not supported**

This parameter is used to decide what bearer shall be used for the connection.

If <bearer>=1 the following parameters are used

Table 10. <cid>: parameter

<cid>	*Description*
integer	Id number of a PDP Context as defined in AT+CGDCONT

Note! There is a one to one mapping between an IA and a PDP context. A certain context can thus not be reused in another IA.

Note! When a certain PDP Context is associated with an Internet Account, it is implied that the Quality of Service Profile with the same id number is also associated. The Quality of Service Profile is defined with AT+CGQREQ and AT+CGQMIN.

Table 12. <pref_serv>: parameter

<pref_serv>	*Description*
0	Automatic
1	Packet Domain Service only

If set to “0” the phone will try to handle incoming CSD services (e.g. phone calls).

Table 13. <pap_chap>: parameter

<pap_chap>	*Description*
0	Normal: Only PAP allowed
1	Secure: Only CHAP allowed
2	None: No authentication scheme is used

This parameter is used to choose which authentication scheme is to be used.

The <lock_state> parameter is set to “1” in the Internet Accounts that are predefined and not possible to alter via the AT-commands. No parameter values can be changed in an Internet Account. If the user tries to change the parameter values, ERROR is returned <err> parameter, refer to +CME ERROR – Mobile Equipment Error Result Code.

7.10 *AT*E2FT IP logging*

Description	*Command*	*Possible responses*
Activate TCP/IP logging	AT*E2FT=<parameter>, <status>	OK ERROR

Description:

The factory test command has been adapted to enable the user turn on IP logging and turn off normal logging which is seen through UART 2 if 2.7V is being supplied to the service pin (58). Once set up the unit needs to be reset, these values are written to flash and need to be reset for normal logging to recommence.

This is helpful when debugging an overall system as it can be seen what the module is doing on an IP level i.e. retrying, etc

Defined values :

Table 1. <parameter> : parameter

<parameter>	*Description*
4	Factory command
5	IP logging
6	Normal logging

Table 2. <status> : parameter

<status>	*Description*
0	Off
1	On (except when parameter = 6, this value turns normal logging off)

Example! AT*E2FT=4,1 Turn the factory command on

OK

AT*E2FT=5,1 Turn IP logging on

OK

AT*E2FT=6,1 Turn normal logging off

OK

8 Data - HSCSD

8.1 *AT+CHSC HSCSD Current Call Parameters*

Description	*Command*	*Possible Responses*
Show the current setting	AT+CHSC	• +CHSC:<rx>,<tx>,<aiur>,<coding> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CHSC=?	• +CME ERROR: <err> • OK • ERROR

Description:

Returns information about the current HSCSD call parameters, i.e. the current number of receive and transmit timeslots, air interface user rate and channel coding.

<rx>	*Description*
0	No HSCSD call is active. See also note below
1	The number of receive timeslots currently in use is 1
2	The number of receive timeslots currently in use is 2

<tx>	*Description*
0	No HSCSD call is active. See also note below
1	The number of transmit timeslots currently in use is 1

<aiur>	*Description*
0	No HSCSD call is active. See also note below.
1	Current air interface user rate is 9.6 kbits/s
3	Current air interface user rate is 19.2 kbits/s

<coding>	*Description*
0	No HSCSD call is active. See also note

4	Current channel coding is 9.6 kbits/s (TCH/F9.6)

8.2 *AT+CHSD HSCSD Device Parameters*

Description	*Command*	*Possible Responses*
Show the current setting	AT+CHSD	• +CHSD: <mclass>,<maxRx>, <maxTx>,<sum>,<codings> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CHSD=?	• +CME ERROR: <err> • OK • ERROR

Description:

Shows information about HSCSD features supported by the ME/TA.

<mclass>	*Description*
2	Multislot class is 2

<maxRx>	Description
2	Maximum number of receive timeslots that ME can use is 2

<maxTx>	*Description*
1	Maximum number of transmit timeslots that ME can use is 1

<sum>	*Description*
3	Total number of receive and transmit timeslots that ME can use at the same time is 3 (i.e. 2+1). The following applies in a HSCSD call: 2 (receive slots) + (transmit slots) <sum>

<codings>	*Description*
4	Indicates that the accepted channel coding for the next established non-transparent HSCSD call is 9.6 kbits/s only

8.3 *AT+CHSN HSCSD Non Transparent Call Configuration*

Description	*Command*	*Possible Responses*
Set HSCSD configuration. This command is also used during a call if new <wAiur> and/or <wRx> are/is desired	AT+CHSN=[<wAiur>[,<wRx>[,<topRx>[,<codings>]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CHSN?	• +CHSN: <wAiur>, <wRx>, <topRx>, <codings> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CHSN=?	• +CHSN: (list of supported <wAiur>s), (list of supported <wRx>s), (list of supported <topRx>s), (list of supported <codings>s) • +CME ERROR: <err> • OK • ERROR

Description:

Controls parameters for non-transparent HSCSD calls. Changing <topRx> or <codings> during a call does not affect the current call. Changing <wAiur> or <wRx> affects the current call only if <topRx> was non-zero when the call was established. When using the command in this way it comes in the “action” command category. This is what is referred to as user initiated up- and down-grading in GSM 02.34 and GSM 03.34.

Note! Recommended value for parameter <speed> in AT+CBST is 0.

<wAiur>	*Description*
0	TA/ME shall calculate a proper number of receive timeslots from currently selected fixed network user rate (<speed> parameter from +CBST command, and <codings>, and <wRx> (or <maxRx> from +CHSD command if <wRx>=0)
1	Wanted air interface user rate is 9.6 kbit/s
2	Wanted air interface user rate is 14.4 kbit/s
3	Wanted air interface user rate is 19.2 kbit/s

<wRx>	*Description*
0	TA/ME shall calculate a proper number of receive timeslots from currently selected <wAiur> and <codings> See note below

1	Wanted number of receive timeslots is 1
2	Wanted number of receive timeslots is 2

<topRx>	*Description*
0	Indicates that the user is not going to change <wAiur> and /or <wRx> during the next call
1	Top value for <wRx> that user is going to request during the next established non-transparent HSCSD call is 1
2	Top value for <wRx> that user is going to request during the next established non-transparent HSCSD call is 2

<codings>	*Description*
4	Indicates that the accepted channel coding for the next established non-transparent HSCSD call is 9.6 kbit/s only

8.4 *AT+CHSR HSCSD Parameters Report*

Description	*Command*	*Possible Responses*
Set HSCSD parameters reporting on or off	AT+CHSR=[<mode>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CHSR?	• +CHSR: <mode> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CHSR=?	• +CHSR: (list of supported <modes>s) • +CME ERROR: <err> • OK • ERROR

Description:

With this command enabled, the intermediate result code +CHSR: <rx>,<tx>,<aiur>,<coding> is returned (from TA to TE) when an HSCSD call is being set up. The result code represents the current (negotiated or renegotiated) HSCSD parameters. If enabled, the intermediate result code is transmitted at the point of the call setup negotiation, where the ME/TA has determined what type of HSCSD connection will be used. Result code transmission is done after possible service (CR), error control (+ER), and/or compression (+DR) reporting, but before possible TE-TA rate (+ILRR) reporting and before

the intermediate result code CONNECT is transmitted. The format of the intermediate result code is:

+CHSR: <rx>,<tx>,<aiur>,<coding>

For the value definitions, refer to AT+CHSC HSCSD Current Call Parameters For instance, for a non-transparent HSCSD call, result code ‘CHSR: 2, 1, 4, 8’ means that the call has two timeslots downlink, one timeslot uplink, the air interface user rate is 28.8 kbits/s and the used channel coding is TCH/F14.4.

<mode>	*Description*
0	Disable reporting
1	Enable reporting

Itermediate Result Codes:

+CHSR: <rx>,<tx>,<aiur>,<coding>

8.5 *AT+CHSU HSCSD Automatic User Initiated Upgrading*

Description	*Command*	*Possible Responses*
Set HSCSD automatic user initiated upgrading on or off	AT+CHSU=[<mode>]	• OK • ERROR
Show the current setting	AT+CHSU?	• +CHSU=<mode> • OK • ERROR
Show if the command is supported	AT+CHSU=?	• +CHSU: (list of supported <modes>s) • OK • ERROR

Description:

Enables or disables the HSCSD automatic user-initiated upgrade.

<mode>	*Description*
0	Disable use of UP bit for upgrading. **Default value**
1	Enable use of UP bit for upgrading

9 GPS Interoperability

This is only for use when using an external processor, it cannot be used with embedded applications.

9.1 *AT*EENMEA NMEA (GPS) Mode on UART2*

Description	*Command*	*Possible Responses*
Enable NMEA commands on the UART	AT*EENMEA=<mode>	• OK • ERROR • +CME ERROR: < err>
Show the current setting	AT*EENMEA?	• *EENMEA:<mode> • +CME ERROR: <err>
Shows if the command is supported	AT*EENMEA=?	• *EENMEA: (list of supported <mode>s) • +CME ERROR: < err>

Description:

This command enables transmission of NMEA commands from UART1 to UART2 and vice versa. The module acts as a transparent link between the GPS device connected to UART2 and the application communicating with it on UART1.

When the application sends the command AT*EENMEA=2 the module is able to handle both AT and NMEA commands simultaneously. If the OK response is received the application can start handling both NMEA and AT commands. Otherwise the response ERROR is returned.

In the mode with simultaneous AT and NMEA commands, <CR> is required after each NMEA command and after the last AT command before the new NMEA. NMEA commands must start with a $. All NMEA commands are forwarded to UART2. All NMEA responses from UART2 are displayed as responses to UART1 along with AT responses.

By sending AT*EENMEA=0, the application ends AT and NMEA commands, simultaneous handling mode. It sends OK, and then returns to AT mode.

The port rate of UART1 for NMEA commands can be controlled using the AT*NMPR command.

Responses	*Description*
OK	The requested action has been performed
ERROR	Following causes of error are considered: - incorrect syntax - NMEA commands have already been enabled in other 07.10 channels

<mode>	*Description*
0	Disable NMEA communication. **Default value**
2	Enable NMEA communication simultaneously with AT commands

9.2 *AT*E2NMPR Ericsson M2M Set NMEA (GPS) Port Rate*

Description	*Command*	*Possible Responses*
Request operation to set data rate for GPS/NMEA Port	AT*E2NMPR=<pr>	• ERROR • OK
Show the current setting	AT*E2NMPR?	*E2NMPR: <pr>
Show if the command is supported	AT*E2NMPR=?	• *E2NMPR: (list of supported <pr>s) • ERROR

Description:

This command allows the user to set the physical Data rate for the GPS/NMEA port. The port rate will be set for the GPS/NMEA port only when NMEA is active - see AT*EENMEA.

<op>	*Description*
o	600 Baud rate
1	1 200 Baud rate
2	2 400 Baud rate
3	4 800 Baud rate
4	9 600 Baud rate. **Default value**
5	19 200 Baud rate
6	38 400 Baud rate
7	57 600 Baud rate
8	115 200 Baud rate
9	230 400 Baud rate

10	460 800 Baud rate

Examples

AT*E2NMPR=?
*E2NMPR=(0-10)
OK

Port rate currently set:

AT*E2NMPR?
*E2NMPR: 4
OK

Set GPS/NMEA port rate to 4800 baud:

AT*E2NMPR=2
OK

10 Fax

10.1 *AT*E2FAX Ericsson M2M Fax Comm. Baud Rate Modification*

Description	*Command*	*Possible Responses*
Request change of fax comm. baud rate	AT*E2FAX= <RcV>	• ERROR • OK
Show the current setting	AT*E2FAX?	• *E2FAX: <RcV> • ERROR
Shows if the command is supported	AT*E2FAX=?	• *E2FAX: (list of supported <RcV>s) • ERROR

Description:

This command allows the modification of the factory default RS232 comm. setting between standard 9600 baud and 19200 baud. This is needed as the addition of fax capabilities, within the module, require communication between fax applications and the module to run at a higher baud rate than the fax transmission baud rate (In this case the fastest transmission rate is 9600 baud). Once this command has been performed, the user must then execute the AT&F command to reset the module with the new RS232 comm's baud rate.

The AT*E2FAX command allows the user to:

- “Configure” the RS232 Comm. speed default factory profile, specifying whether the speed should be 9600 baud (standard) or 19200 baud for FAX application comm. This value will then be used once the AT&F command is next used.
- “Read” what value this default factory profile has been set to.

<RcV>	*Description*
0	Configure RS232 default setting to 9600 baud
1	Configure RS232 default setting to 19200 baud

Example

AT*E2FAX=?

*E2FAX= (0-1)
OK

AT*E2FAX?

*E2FAX: 0 (Current default setting is 9600 baud)
OK

AT*E2FAX=0

OK (Sets default RS232 setting to 9600 baud)

10.2 *Low Level Fax Commands*

The following table of low level fax commands are supported and used by the GR47 for fax operation.

AT+FAA	AT+FBADLIN	AT+FBADMUL
AT+FBOR	AT+FBUG	AT+FCIG
AT+FCLASS	AT+FCQ	AT+FCR
AT+FDCC	AT+FDFFC	AT+FDIS
AT+FDR	AT+FDT	AT+FECM
AT+FET	AT+FK	AT+FLID
AT+FLNFC	AT+FLPL	AT+FMDL?
AT+FMFR?	AT+FMI?	AT+FMINSP
AT+FMM?	AT+FMR?	AT+FPHCTO
AT+FPTS	AT+FRBC	AT+FREL
AT+FREV?	AT+FRH	AT+FRM
AT+FRS	AT+FSPL	AT+FTBC
AT+FTH	AT+FTM	AT+FTS
AT+FVRFC	AT+FWDFC	

11 Identification

11.1 *AT Attention Command*

Description	*Command*	*Possible Responses*
Checks the communication between the MS and application	AT	• OK • +CME ERROR <err>

Description:

This command is used to determine the presence of an MS. If the MS supports AT commands, it returns an OK final result code.

11.2 *AT&F Set to Factory Defined Configuration*

Description	*Command*	*Possible Responses*
Execute	AT&F	• OK • ERROR
Show if the command is supported	AT&F=?	&F: (list of supported <profile>s)

Description:

This command instructs the DCE to set all parameters to default values specified by the manufacturer, which may take in consideration hardware configuration and other manufacturer defined criteria.

11.3 *AT&W Store User Profile*

Description	*Command*	*Possible Responses*
Stores the current user profile to non volatile memory	AT&W=[<pr>] or AT&W[<pr>]	• OK • ERROR
Show if the command is supported	AT&W=?	&W: (list of supported <pr>s)

Description:

This command stores the current user profile in non-volatile memory. The user profile consists of all of the user configurable settings other than those set by AT+CBST. If the unit is powered down and back up gain this is the profile it will use.

< pr>	*Description*
0	Stores current settings in User Profile 0

11.4 *AT* List all Supported AT Commands*

Description	*Command*	*Possible Responses*
List all implemented AT commands	AT*	<AT Command1> [<CR> <LF> <AT Command2>[…]] / <AT Command1> [<CR> <LF> <AT Command2>[…]]

Description:

Lists all the commands supported by the MS.

11.5 *AT+CGMI Read MS Manufacturer Identification*

Description	*Command*	*Possible Responses*
Request manufacturer identification	AT+CGMI	• <manufacturer> • +CME ERROR: <err>
Show if the command is supported	AT+CGMI=?	• OK • ERROR

Description:

Causes the MS to return one or more lines of information text.

<manufacturer>	*Description*
Sony Ericsson	This company's name is displayed

Example! AT+CGMI
Sony Ericsson

OK

11.6 *AT+CGMM Read MS Model Identification*

Description	*Command*	*Possible Responses*
Request the model identification	AT+CGMM	• <model type> <model name> • +CME ERROR: <err>
Show if the command is supported	AT+CGMM=?	• OK • ERROR

Description:

Causes the MS to return one or more lines of information text <model>, determined by the MS manufacturer. It is intended to permit the user of the ITAE/ETAE to identify the specific model of the MS to which it is connected. Typically the text will consist of a single line containing the name of the product, but manufacturers may choose to provide more information if desired.

<model type>	*Description*
String type	A unique ASCII character/digit string, always 10 characters long. Spaces are used when the number of characters/digits is less than 10

<model name>	*Description*
String type	Model name for the transceiver unit, for example, GR47

Example! AT+CGMM
6100501-BVGR47

OK

11.7 *AT+CGMR Read MS Revision Identification*

Description	*Command*	*Possible Responses*
Request MS revision identification string	AT+CGMR	• <revision> • +CME ERROR: <err>
Show if the command is supported	AT+CGMR=?	• OK • ERROR

This command causes the MS to return a string containing information about the software version.

<revision>	*Description*
String type	An ASCII string containing date (year, month, day, hour, minute) plus KRC number. Example: R5B009 CXC 1122528

11.8 *AT+CGSNRead MS Product Serial Number Identification*

Description	*Command*	*Possible Responses*
Request product serial number	AT+CGSN	• <sn> • +CME ERROR: <err>
Show if the command is supported	AT+CGSN=?	• OK • ERROR

Description:

This command causes the MS to return the IMEI (International Mobile station Equipment Identity), which identifies the individual ME.

<sn>	*Description*
String	The IMEISV, which is the IMEI (International Mobile station Equipment Identity; refer GSM 03.03) number of the ME and the software version number. Text shall not contain the sequence 0<CR> or OK<CR>

11.9 *AT+GMI Read Manufacturer Identification*

Description	*Command*	*Possible Responses*
Request manufacturer identification	AT+GMI	<manufacturer>
Show if the command is supported	AT+GMI=?	• OK • ERROR

Description:

This command causes the DCE to transmit one or more lines of information text. Typically, the text will consist of a single line containing the name of the manufacturer, but may provide more information such as address and telephone number for customer service.

<manufacture>	*Description*
string type	The total number of characters, including line terminators, in

	the information text returned in response to this command shall not exceed 2048 characters. Note that the information text shall not contain the sequence “0” or “OK”, so that DTE can avoid false detection of the end of this information text

11.10 *AT+GMM Read Model Identification*

Description	*Command*	*Possible Responses*
Request revision identification	AT+GMM	<model>
Show if the command is supported	AT+GMM=?	• OK • ERROR

Description:

This command causes the DCE to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the DCE to identify the specific model of device. Typically, the text will consist of a single line containing the name of the product, but manufacturers may choose to provide any information desired.

<model>	*Description*
string type	The total number of characters, including line terminators, in the information text returned in response to this command shall not exceed 2048 characters. Note that the information text shall not contain the sequence “0 ” or “OK”, so that DTE can avoid false detection of the end of this information text

11.11 *AT+GMR Read Revision Identification*

Description	*Command*	*Possible Responses*
Request revision identification	AT+GMR	<revision>
Show if the command is supported	AT+GMR=?	• OK • ERROR

Description:

This command returns a manufacturer specified software revision name in a text string.

<revision>	*Description*
string type	The total number of characters, including line terminators, in

	the information text returned in response to this command shall not exceed 2048 characters. Note that the information text shall not contain the sequence “0” or “OK”, so that DTE can avoid false detection of the end of this information text.

Example! AT+GMR
R2A009prgCXC1122112

11.12 *ATI Identification Information*

Description	*Command*	*Possible Responses*
Execute	ATI[<value>]	<information>

Description:

This command causes the DCE to transmit one or more lines of text, followed by a final result code. As an option, <value> can be used to select from among multiple types of identifying information as shown in the table below.

This command provides compatibility with Microsoft Windows 95.

<value>	*Description*
0	Same information as +GMM command (model identification)
1	Same information as +GMR command (revision identification)
3	Modem model description
5	Active settings
7	Modem configuration profile (brief listing of the modem functionality: fax classes, Bluetooth, IrDA, modem type, etc.)
8	DCE hardware type version
9	PnP (plug and play) information

Examples

ATI=1
CXC1122112

ATI=5
Configuration Settings on Channel 0
&C: 1
&D: 0
*EENMEA: 0

+CGACT: 1,0
+CGATT: 0
+CGDCONT: 1,“IP”,“internet”,“”,0,0
+CGEREP: 0,0
+CGREG: 0,3
+CHSR: 0
+CHSU: 0
+CMEE: 1
+CMUX: 0,0,1,31,10,3,30,10,2
+CR: 0
+CRC: 0
+CRLP: 61,61,48,6,0
+CRLP: 120,120,48,6,2,3
+CVHU: 2
+ICF: 3,3
+IFC: 2,2
+ILRR: 0
+IPR: 115200
E: 1
M: 0
Q: 0
S0: 000
S10: 002
S2: 043
S3: 013
S4: 010
S5: 008
S6: 002
S7: 050
S8: 002
V: 1
X: 4

OK

12 Input/Output

12.1 *AT*E2IO Ericsson M2M Input/Output Read/Write*

Description	*Command*	*Possible Responses*
Request operation with the I/O signals	AT*E2IO=<op>,<io> [,<val>][,<adc_val>]	• ERROR • OK • *E2IO: <op>,<io>[,[<val>] [,<adc_val>]] OK
Show if the command is supported	AT*E2IO=?	• *E2IO: (list of supported <IO>s), (list of supported <ip>s), (list of supported <op>s), (list of supported <adc>s), (list of supported <dac>), (list of supported <val>s),(list of supported <adc_val>s) • ERROR

Description:

The module has the following digital I/Os; nine configurable GPIOs, four input-only, and four output-only.

The module also has five ADCs, and one DAC. All of these signals are controlled by the AT*E2IO command dependent on whether they are available (not used by UART1 or UART3) or 'switched in' at the time – see notes below.

A list of available IO and the default usage is shown below:

<IO>	*Description*
IO1	(Pin 21 default) muxed with I2
IO2	(Pin 22 default) muxed with ADC5
IO3	(Pin 23 default) muxed with I3 – also used as UART3 CTS
IO4	(Pin 24 default) muxed with I4 – also used as UART3 RTS
IO5	(Pin 13 default) muxed with ADC4
IO6	(Pin 33) LED as default
IO7	(Pin 43 default) muxed with UART3 Tx (when UART3 is opened - IO7 is disabled)
IO8	(Pin 44 default) muxed with UART3 Rx (when UART3 is opened - IO8 is disabled)

IO9	(Pin 45) UART1 RTS as default
I1	(Pin 37) UART1 DTR as default
I2	(Pin 21) muxed with IO1
I3	(Pin 23) muxed with IO3
I4	(Pin 24) muxed with IO4
O1	(Pin 38) UART1 DCD as default
O2	(Pin 36) UART1 RI as default
O3	(Pin 32) UART1 DSR as default
O4	(Pin 40) UART1 CTS as default
AD1	(Pin 26)
AD2	(Pin 27)
AD3	(Pin 28)
AD4	(Pin 13) muxed with IO5
AD5	(Pin 22) muxed with IO2
DA1	(Pin 20)

Note! IO1 to IO9 are set to INPUT as a factory default. Their status (Input/Output) is stored in non-volatile memory.

IO9, I1, O1, O2, O3 and O4 are not available by default. These pins are shared with RS232 functionality and only become active if the AT*E2RS232 command is used, see AT*E2RS232 Ericsson RS232 control mode, page 141.

IO7, IO8, IO3 and IO4 are available by default but are multiplexed with UART 3 pins (Rx,Tx, CTS, RTS). When UART3 is opened without flow control IO7,IO8 are not available as GPIO. When UART3 is opened with hardware flow control IO7, IO8, IO3 and IO4 are not available as GPIO. These pins become available as GPIO again when UART3 is closed.

IO6 is only available as an input as it is shared with the LED.

Set command controls the operations with the I/O signals for the M2M devices. It is possible to perform up to five operations. These operations have the following meaning:

- **Read** (<op> = 0): It reads the state of the specified signal. It returns the binary state of digital signals or value (0-255) of

an ADC input or the DAC output. In case of a digital I/O the command has the following syntax:

```
AT*E2IO=0,“IO1”
*E2IO: 0,“IO1”,0

OK
```

If reading from the ADC/DACs:

```
AT*E2IO=0,“AD1”
*E2IO: 0,“AD1”,,62

OK
```

- **Write** (<op> = 1): Sets an output to a specific value. For digital sources <val>=‘0’ or ‘1’ and for the analog sources, 0-255. If the signal is bi-directional (IO1 to IO5) it must be configured as an output before writing is allowed. If the output can be written to, the signal is set to <val> and OK is returned, otherwise ERROR is returned.

```
AT*E2IO=1,“IO1”,1

OK

or

AT*E2IO=1,“DA1”,,100

OK
```

- **Configure** (<op> = 2): The configuration operation is used for the bi-directional signals (IO1 to IO5). They can be configured as input, <val>= ‘0’ or output, <val>=‘1’. If the signal is not configurable, ERROR is returned in place of OK. Once set, the signal remains configured even after a power cycle. Example shown below:

```
AT*E2IO=2,“IO1”,1    (Set IO1 as an output)

OK
```

- **Configure Check** (<op> = 3): This operation reads the current configuration of the signal. Returned <val> is current

signal state. If the signal is configurable, the current state and OK are returned, if not ERROR is returned.

```
AT*E2IO=3,“IO1”
*E2IO: 3,“IO1”,1        (IO1 is currently set as an output)

OK
```

- **Trigger** (<op> = 4): Input signals can be set to send an unsolicited result code whenever a change in one of the inputs has been produced. Setting a trigger (<val> = ‘1’) will cause the unsolicited result to be sent when a change from the current signal state occurs (signal must be unchanging when command is executed). Clearing a trigger (<val> = ‘0’) will clear a currently set trigger. Configurable signals (IO1 to IO5) must be set as inputs before they can be triggered. Triggers are only applicable while the module is ON. Power-cycling will clear all current triggers. If a signal is triggerable OK is returned and the trigger is set/cleared, otherwise ERROR is returned.

```
AT*E2IO=4,“IO5”,1    (Set trigger on IO5)

OK

(IO5 changes state, sometime later)

*E2IO: 3,“IO5”,1        (IO5 triggered, current state ‘1’)
```

- **Trigger Check** (<op> = 5): Checks if a signal input is configured as a trigger. Returned <val> shows the current trigger state; ‘1’ for triggered or ‘0’ for not triggered. If the signal is triggerable, the current trigger status and OK are returned, otherwise ERROR is returned.

```
AT*E2IO=5,“IO5”
*E2IO: 5,“IO5”,1        (IO5 is currently set to trigger)

OK
```

- **Pinswitch** (<op> = 6): Some of the IO lines are multiplexed and are only available after being ‘switched in’ by use of this operation i.e.

```
AT*E2IO=6,“I2”
OK
```

- **Pinstatus** (<op> = 7): returns (<val>) - the pin status of the specified pin where:

  0 = Pin Switched Out (not available on connector until switched in – see Pinswitch)

1 = Pin In Use by Apps internally or not allowed for use

2 = Pin used internally by signalling software for RS232 control (can be made available as GPIO with AT*E2RS232 cmd)

3 = Pin available for Use

AT*E2IO=6,“I2”
OK
AT*E2IO =7,"I2"
*E2IO: 7,"I2",3

The test command returns the supported I/Os and allowed value ranges.

Abortability:

This command may not be aborted.

<op>	*Description*
0	Read
1	Write
2	Configure
3	Configure Check
4	Trigger
5	Trigger Check
6	Pin Switch
7	Pin Status

<io>	*Description*
IO1	IO1. Supported Operations: 0,1,2,3,4,5,6,7
IO2	IO2. Supported Operations: 0,1,2,3,4,5,6,7
IO3	IO3. Supported Operations: 0,1,2,3,4,5,6,7
IO4	IO4. Supported Operations: 0,1,2,3,4,5,6,7
IO5	IO5. Supported Operations: 0,1,2,3,4,5,6,7
IO6	IO6. Supported Operations: 0,2,3,7
IO7	IO7. Supported Operations: 0,1,2,3,7
IO8	IO8. Supported Operations: 0,1,2,3,7

IO9	IO9. Supported Operations: 0,1,2,3,7
I1	Digital Input 1. Supported Operation 0,7
I2	Digital Input 2. Supported Operation 0,6,7
I3	Digital Input 3. Supported Operation 0,6,7
I4	Digital Input 4. Supported Operation 0,6,7
O1	Digital Output 1. Supported Operations: 0,1,7
O2	Digital Output 2. Supported Operations: 0,1,7
O3	Digital Output 3. Supported Operations: 0,1,7
O4	Digital Output 4. Supported Operations: 0,1,7
AD1	Analogue/Digital Output 1: Supported Operations: 0,7
AD2	Analogue/Digital Output 2: Supported Operations: 0,7
AD3	Analogue/Digital Output 3: Supported Operations: 0,7
AD4	Analogue/Digital Output 4: Supported Operations: 0,6,7
AD5	Analogue/Digital Output 5: Supported Operations: 0,6,7
DA1	Digital/Analogue Input: Supported Operations: 0,1,7

<val>	*Description*		
	Read/Write	Configure	Trigger
0	The logic value is FALSE	I/O signal is INPUT	I/O signal is NOT set to trigger
1	Logic value is TRUE	I/O signal is OUTPUT	I/O signal is set to trigger

<adc_val>	*Description*
0-255	The decimal value shall represent the analogue voltage it is hold on the I/O. Applicable only to A/D or D/A signals.

Unsolicited Result Codes:

*E2IO: <source>, <io>, <val>

Scenario Cases

Reading an I/O

AT Command	*Response*	*Comment*
AT*E2IO=0,“I1”		The TE is requesting for the logic value of I1 (Digital Input 1)
	*E2IO:0,“I1”,1 OK	The MS responds I1 has a TRUE logic value
AT*E2IO=0,“AD1”		The TE is requesting for the reading of AD1 value (Analogue Input 1)
	*E2IO:0,“AD1”, ,87 OK	The MS responds AD1 has a decimal value of 87. In volts: ((2.75*0.9)/256)*87 = 0.841 V

Writing in an Output

AT Command	*Response*	*Comment*
AT*E2IO=1,“O1”,1		The TE is requesting to write a TRUE logic to O1 (Digital Output 1)
	OK	The MS responds OK because the operation has been performed
AT*E2IO=1,“I3”,0		The TE is requesting to write a FALSE logic value to I3 (Digital Input 3)
	ERROR	The MS responds ERROR because the operation is not possible
AT*E2IO=1,“DA1”,95		The TE is writing 95 decimal value to hold a voltage of: ((2.75*0.9)/256)*95 = 0.918 V
	OK	The MS responds OK because the operation has been performed

Configuring an I/O

AT Command	*Response*	*Comment*
AT*E2IO=2,”IO1”,0		The TE is requesting to configure IO1 as an input
	OK	The MS responds OK because the operation has been performed
AT*E2IO=2,”IO4”,1		The TE is requesting to configure IO4 as an output
	OK	The MS responds OK because the

		operation has been performed

Checking an I/O status

AT Command	*Response*	*Comment*
AT*E2IO=3,“IO1”		The TE is requesting to check the configuration of the IO1 signal
	*E2IO:3,“IO1”,0 OK	The MS responds IO1 is configured as an input
AT*E2IO=3,“IO4”		The TE is requesting to check the configuration of the IO4 signal
	*E2IO:3,“IO4”,1 OK	The MS responds IO4 is configured as an output

Triggering an Input

AT Command	*Response*	*Comment*
AT*E2IO=4,“IO1”,1		The TE is requesting to trigger IO1
	OK	The MS responds OK because the operation has been performed
AT*E2IO=4,“IO4”,0		The TE is requesting to not trigger IO4
	OK	The MS responds OK because the operation has been performed
	*E2IO:4,“IO1”,1 OK	An event has occurred. The IO1 has triggered on changing the input to logic value 1

Checking an Input Trigger

AT Command	*Response*	*Comment*
AT*E2IO=5,“I1”		The TE is requesting the trigger state of the Input 1
	*E2IO=5,“I1”,1 OK	The MS responds that I1 has its trigger active

12.2 AT*E2U3 Ericsson M2M UART 3 Control

Description	*Command*	*Possible Responses*
Request operation	AT*E2U3=<op>[,<rate>][<CR> Tx data <ctrl-Z/ESC>]	ERROR OK *E2U3:<CR><LF>Rx data
Show if the command is supported	AT*E2U3=?	OK ERROR

Description:

Provides the following options for control of the UART 3 interface.

- Open connection - Opens the Uart 3 driver to Rx and Tx data.
- Transmit Data - The TA prompts for data entry and up to 250 text characters can be entered. Entry is terminated by the <ctrl-Z> character or the <ESC> character cancels the command.
- Receive Data - The TA responds with *E2U3:<CR><LF> followed by the contents of the Uart 3 receive buffer.
- Close connection - Closes the Uart 3 driver and frees resources.

Defined values:

<op>: parameter

OP	*Description*
0	Close UART3 connection
1	Open UART3 connection
2	Transmit Data to UART3
3	Receive Data from UART3

<rate>: parameter

<rate>	Description
Discrete integer value	The <rate> value is the rate in bits per second at which the UART3 interface will operate. The following rates are supported: 1200 2400 4800 9600

19200 38400 57600 115200 230400 460800

Examples

Open channel at 9600 baud

AT*E2U3=1,9600

OK

Transmit data to UART 3

AT*E2U3=2

> Tx data<ctrl-Z>

OK

Receive data from UART 3

AT*E2U3=3

*E2U3:

Rx data

OK

Close UART 3 channel

AT*E2U3=0

OK

12.3 *AT*E2RS232 Ericsson RS232 control mode*

Description	*Command*	*Possible Responses*
Select RS232 control mode	AT*E2RS232=<Val>	• ERROR • OK
Read Command status	AT*E2RS232?	• *E2RS232: <Val> • OK • ERROR
Show if the commands is supported	AT*E2RS232=?	• *E2RS232: (list of supported <Val> • OK

	• ERROR

Description:

On GR47, the RS232 control lines on UART 1 are multiplexed with general purpose IO lines as follows:

RTS (IO9), CTS (O4), DCD (O1), RI (O2), DSR (O3), DTR (IN1)

This command allows the user to select 3 different levels of RS232 control such that the some of the control lines may be used as IO.

The following table shows the role of the control/IO pins with respect to the mode selected with this command:

Table 1. RS232 control pin usage

Mode	*Rs232 control lines*	*Extended IO lines*	*Description*
0	Tx, Rx, RTS, CTS, DCD, RI, DSR, DTR		Full RS232 control
1	Tx, Rx, RTS, CTS	O1, O2, O3, IN1	Hardware flow control only
2	Tx, Rx	O1, O2, O3, IN1, IO9, O4	RS232 control off (all lines used for IO)

Note! RTS (IO9) / CTS(O4) can not be controlled with AT*E2IO at this stage.

Note! This status is not saved by the AT&W command.

Abortability:

This command may not be aborted.

Defined values

Table 1. <Val>: parameter

<ind>	*Description*
0	full rs232 functionality - all control lines used by RS232 (as default on powerup)
1	Hardware handshake only (RTS/CTS) (DCD,RI,DSR, DTR - converted to IO usage asO1, O2, O3, IN1)
2	All Rs232 control lines swapped out for general use by IO (see table above)

Unsolicited Response Codes:

none

Unsolicited Response parameters

none

13 Interface

13.1 *AT+CPIN PIN Control*

See 3.29, AT+CPIN PIN Control

13.2 *AT&C Circuit 109 (DCD) Control*

Description	*Command*	*Possible Responses*
Set behavior of carrier detect	AT&C[<value>]	OK ERROR

Description:

Determines the behaviour of the carrier detect.

<value>	*Description*
0	DCD always on
1	DCD follows the connection. **Default value**

Note! If in online command mode, while running a TCP/IP session through AT Commands, DCD will only be updated when returning to online data mode using ATO.

13.3 *AT&D Circuit 108 (DTR) Response*

Description	*Command*	*Possible Responses*
Control actions from DTE	AT&D[<value>]	OK ERROR

Description:

Controls all actions initiated by data terminal ready from DTE.

<value>	*Description*
0	Ignore. **Default value**
1	When in on-line data mode, switch to on-line command mode. For all other states, see <value>=2
2	Disconnect and switch to off-line command mode

13.4 *AT&S Circuit 107 (DSR) Response*

Description	*Command*	*Possible Responses*
Set behavior of data set ready	AT&S[<value>]	• OK • ERROR

Description:

Determines the behavior of the data set ready signal.

<value>	*Description*
0	DSR always on
1	DSR on in data mode. DSR off in command mode. **Default value**

13.5 *AT+WS46 Mode Selection*

Description	*Command*	*Possible Responses*
Sets the cellular protocol mode	AT+WS46=n	• OK • ERROR
Show the current setting	AT+WS46?	• <n> OK • ERROR
Show if the command is supported	AT+WS46=?	• (list of supported <n>s) OK • ERROR

Description:

Allows an accessory to query and control the cellular protocol mode of the ME.

<n> parameter	*Description*
12	This value is used for GSM at 900 Mhz., DCS-1800, and PCS-1900 phones

13.6 *ATE Command Echo*

Description	*Command*	*Possible Responses*
Request Command Echo	ATE[<value>] ATE=[<value>]	• OK • ERROR
Show the current setting	ATE?	<value>
Show if the command is supported	ATE=?	E: (list of supported <value>s)

Description:

The setting of this parameter determines whether or not the DCE echoes characters received from the DTE during command state and online command state.

<value>	*Description*
0	DCE does not echo characters during command state and online command state
1	DCE echoes characters during command state and online command state. **Default value**

13.7 *ATV DCE Response Format*

Description	*Command*	*Possible Responses*
Set DCE response format	ATV[=]<value>	• OK • ERROR
Show the current setting	ATV?	V: <value>
Show if the command is supported	ATV=?	V: (list of supported <value>s)

Description:

Select either descriptive or numeric response codes. The ATV command sets the verbose numeric response codes and strips off the <S3><S4> additions to the command response.

<value>	*Description*
0	Display numeric result codes
1	Display verbose result codes. **Default value**

List of result codes

ATV1/ATV=1	*ATV0/ATV=0*	*Description*
OK	0	Acknowledges execution of a command
CONNECT	1	A connection has been established; the DCE is moving from command state to online data state
RING	2	The DCE has detected an incoming call signal from the network
NO CARRIER	3	The connection has been terminated or the attempt to establish a connection failed
ERROR	4	Command not recognized, command line maximum length exceeded, parameter value invalid, or other problem with processing the command line
NO DIALTONE	6	No dial tone detected
BUSY	7	Engaged (busy) signal detected
NO ANSWER	8	**"**@" (Wait for Quiet Answer) dial modifier was used, but remote ringing followed by five seconds of silence was not detected before expiration of the connection timer
CONNECT <TEXT>	Manufacturer-specific	Same as CONNECT, but includes manufacturer-specific text that may specify DTE speed, line speed, error control, data compression, or other status

13.8 *ATZ Reset to Default Configuration*

Description	*Command*	*Possible Responses*
Execute	ATZ	• OK • ERROR
Execute	ATZ=<profile>	• OK • ERROR
Show if supported and list available parameter range	ATZ=?	Z: (list of supported <profile>s)

Description:

This command instructs the DCE to set all parameters to their default values as specified by the user. Consider hardware configuration switches or non-volatile parameter storage (if implemented) when using this command.

Commands included on the same command line as the Z command will be ignored.

<profile >	*Description*
0	Select the user profile to restore

13.9 AT+CMUX Switch to 07.10 Multiplex Protocol

Description	*Command*	*Possible Responses*
Switch to 07.10	AT+CMUX=<transparency>[,<subset>[,<port_speed>[,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]	+CME ERROR: <err>
Show the current setting	AT+CMUX?	• +CMUX:<transparency>,<subset>,<port_speed>,<N1>,<T1>,<N2>,<T2>,<T3>[,<k>] • +CME ERROR: <err>
Show if the command is supported	AT+CMUX=?	• +CMUX: (list of supported <transparency>s), (list of supported <subset>s), (list of supported <port_speed>s), (list of supported <N1>s), (list of supported <T1>s), (list of supported <N2>s), (list of supported <T2>s), (list of supported <T3>s), (list of supported <k>) • +CME ERROR: <err>

Description:

The command is used to turn on the multiplexer. Only “no transparency is supported”. The parameter <k> is not used.

The default values for the parameters below are for “no transparency” and “only UIH frames used”.

<transparency>	*Description*
0	No transparency

<subset>	*Description*
0	Only UIH frames used

<port_speed>	*Description*
1	9 600 bits/s
2	19 200 bits/s

3	38 400 bits/s
4	57 600 bits/s
5	115 200 bits/s
6	230 400 bits/s
7	460 800 bits/s

<N1>	*Description*
31	Default maximum frame size

<T1>	*Description*
10	100ms default timer

<N2>	*Description*
3	Default maximum number of re-transmissions

<T2>	*Description*
30	300ms default timer

<T3>	*Description*
10	10 s default timer

<k>	*Description*
1..7	Window size

13.10 *AT+CRES Restore SMS Settings*

Description	*Command*	*Possible Responses*
Restore settings	AT+CRES[=<profile>]	• +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CRES=?	• +CRES: (list of supported <profile>s) • +CMS ERROR: <err> • OK • ERROR

Description:

Restores message service settings from non-volatile memory to active memory. A TA can contain several profiles of settings. Settings specified in commands Service Centre Address +CSCA, Set Message Parameters +CSMP and Select Cell Broadcast Message Types +CSCB (if implemented) are restored. Certain settings, such as SIM SMS parameters, cannot be restored.

<profile>	*Description*
0..2	Profile number where settings are to be stored. **Default value is 0**

13.11 *AT+ICF Cable Interface Character Format*

Description	*Command*	*Possible Responses*
Defines DTE-DCE character framing	AT+ICF=[format[,parity]]	• OK • ERROR
Show the current setting	AT+ICF?	• +ICF: <format>,<parity> • OK • ERROR
Show if the command is supported	AT+ICF=?	• +ICF: (list of supported <format>s), (list of supported <parity>s) • OK • ERROR

Description:

This extended-format compound parameter is used to determine the local serial port start-stop (asynchronous) character framing used by the DCE to accept DTE commands, and while transmitting information text and result code, if this is not automatically determined; **(Not supported)** +IPR=0 forces +ICF=0 (see +IPR).

<format>	*Description*
3	8 Data 1 Stop. **Default value**

<parity>	*Description*
3	Space. **Default value**

Example! AT+ICF?
+ICF: 3,3

OK

13.12 *AT+IFC DTE-DCE Local Flow Control*

Description	*Command*	*Possible Responses*
Defines DTE-DCE local flow control	AT+IFC=[<by_te>, [<by_ta>]]	• OK • ERROR
Show the current setting	AT+IFC?	+IFC: <by_te>,<by_ta>
Show if the command is supported	AT+IFC=?	+IFC: (list of supported <by_te>s,<by_ta>s)

Description:

Defines the flow control between the modem and the computer when in on-line data mode.

No flow control is enabled in any of the command modes.

<by_te>	*Description*
0	No flow control on DTE
1	Xon/Xoff flow control on DCE. Control characters are removed by the DCE interface
2	RTS flow control on DCE. **Default value**
3	Xon/Xoff flow control on DCE. Control characters are passed to the remote DCE/DTE

<by_ta>	*Description*
0	No flow control on DCE
1	Xon/Xoff flow control on DTE
2	CTS flow control on DCE. **Default value**

Note! Regardless of how this command is configured, if 3 wire communication between the module and the application is required then the RTS and CTS lines (on the module) should be looped back on each other as the chipset requires this at a hardware level.

13.13 *AT+ILRR Cable Interface Local Rate Reporting*

Description	*Command*	*Possible Responses*
Defines DTE-DCE character framing	AT+ILRR=<value>	• OK • ERROR
Show the current setting	AT+ILRR?	+ILRR:<value>
Show if the command is supported	AT+ILRR=?	+ILRR:(list of supported <values>s)

Description:

Specifies whether or not the extended-format “+ILRR:<rate>” information text is transmitted from the DCE to the DTE. The <rate> reported shall represent the current (negotiated or renegotiated) DTE-DCE rate. If enabled, the intermediate result code is transmitted after any modulation, error control or data compression reports are transmitted, and before any final result code (e.g. CONNECT) is transmitted. The <rate> is applied after the final result code is transmitted.

<value>	*Description*
0	Disables reporting of local port rate (+ILRR: is not transmitted). **Default value**
1	Enables reporting of local port rate (+ILRR: is transmitted)

13.14 *AT+IPR Cable Interface Port Command*

Description	*Command*	*Possible Responses*
Defines fixed DTE rate	AT+IPR=[rate]	• OK • ERROR
Show the current setting	AT+IPR?	• +IPR:<rate> • OK • ERROR
Show if the command is supported	AT+IPR=?	• +IPR: (), (list of fixed-only <rate>s)] • OK • ERROR

Description:

Specifies the data rate at which the DCE will accept commands, in addition to 1200 bits/s or 9600 bits/s (as required in v25ter, subclause 4.3). It may be used to select operation at rates used by the DTE, which the DCE is not capable of automatically detecting.

The specified rate takes effect following the issuance of any result code(s) associated with the current command line.

<rate>	*Description*
Discrete integer value	The <rate> value specified shall be the rate in bits per second at which the DTE-DCE interface should operate, e.g. “19 200” or “115 200”. The rates supported by a particular DCE are manufacturer specific. The following rates, are supported; 1 200 2 400 4 800 9 600 19 200 38 400 57 600 115 200 230 400 460 800

13.15 *AT*E2SPI Serial Peripheral Interface*

Description	*Command*	*Possible Responses*
Set Serial Peripheral interface	AT*E2SPI=<op> [,<byteformat> [,<InitSync>]] [,<byte1>,<byte2>,..., <byte n>]	• ERROR • OK • *E2SPI: <byte1rx>,<byte2rx>,..., <bytenrx> OK
Show the current setting	AT*E2SPI?	• *E2SPI: <active>, <byteformat> OK
Shows if the command is supported	AT*E2SPI=?	• *E2SPI: (list of supported <op>s,list of supported <byteformat>s, list of supported <InitSync>s) • ERROR

Description:

This command allows the user to send data via an SPI bus. The SPI bus is made up from the IO pins (IO1 = Clock, IO2 = Data In, IO3 = Data Out, and O2/RI = Sync (optional)).

The bus works with the GR47 being the SPI master. The clock is generated by the GR47, and on each clock cycle, data is both transmitted on the Data Out pin, and received on the Data in pin. The Sync pin (optional) can be used as a chipselect pin for latching the data after a number of bytes have been sent. The

initial state of the Sync pin can be set, so it is toggled from that state.

Once the SPI bus is enabled, the IOs that are used can not be used for any other purpose until the SPI is disabled. This means the AT*E2IO command cannot modify these pins, and if the Sync pin is activated, RI will not be output.

Three operations can be made on the SPI bus:

SPI Enable (<op> = 255)

This command is entered to set up the SPI bus, and to enable the relevant signals. The byte format is defined here (the number of bytes output between toggling the Sync pin high and low). The Initial state of the Sync pin is also defined. If the byte format is set to zero (0), then the Sync pin is not used, and is not controlled by the SPI.

Example! AT*E2SPI=255,2,1<CR>

OK

This command sets the SPI bus active, and the Sync pin is made toggle every 2 bytes of output data. The initial state of the Sync pin is HIGH.

SPI Send/Receive (<op> = 1-32)

This command sends from 1 - 32 bytes of data across the enabled SPI bus. Data is sent MSB first, from the first byte to the last byte.

Example! AT*E2SPI=8,170,170,85,85,170,170,85,85<CR>

OK

This command sends 8 bytes (170,170,85,85,170,170,85,85) across the SPI bus. Bytes are in decimal format.

SPI Disable (<op>= 0)

This command is sent to disable the SPI functionality, and restore use of IO pins to other applications. The SPI bus must be disabled before being enabled with a new set of parameters.

AT*E2SPI=0

OK

<op>	*Description*
0	Disable SPI bus
1-32	Send/ receive 1-32 bytes

255	Enable SPI bus

<byteformat>	*Description*
0	No Sync Pin function
1-32	Sync is toggled every 1-32 bytes sent/received

<InitSync>	*Description*
0	Sync Pin initial state LOW
1	Sync Pin initial state HIGH

<byte x>, <byte x rx>	*Description*
0-255	decimal value denoting the byte value to be sent

<active>	*Description*
0	SPI bus is active (pins are controlled by SPI)
1	SPI bus is not active (pins are not controlled by SPI)

13.16 *AT*E2ESC M2M Escape Sequence Guard Time*

Description	*Command*	*Possible responses*
Set GPRS online command guard time	AT*E2ESC=[<gt>]	• OK • ERROR
Show the current setting	AT*E2ESC?	*E2ESC: <gt>
Show if the command is supported	AT*E2ESC=?	• OK • ERROR

Description:

Defines a guard time for the escape sequence in GPRS and Circuit-Switched Online Data Mode to return to online command mode i.e. if +++AT<CR> is received either as part of the data stream or a terminating string from the application and no further data is received for the duration of the guard time the module will go into on line command mode. This guards against the module accidentally going into on line command mode. The verbose format of +++AT<CR> is <S2><S2><S2>AT<S3>.

<gt>	*Description*
0	No guard time. **Default value**
1-10	Guard time in seconds

14 Network

14.1 *AT*E2CD Ericsson M2M Cell Description*

Description	*Command*	*Possible Responses*
Request network cell description	AT*E2CD=<n>	• ERROR • OK
Show the current setting	AT*E2CD?	• *E2CD: <n>,<lac>,<ci>,<ta> • ERROR
Show if the command is supported	AT*E2CD=?	• *E2CD: (list of supported <n>s) • ERROR

Description:

Controls the presentation of an unsolicited result code E2CD: when <n>=1, or when there is a change in one of the network cell parameters, E2CD: <lac>,<ci>,<ta>.

Read command returns the status of result code presentation and several values, which show the network cell parameters.

Location information <lac>, <ci> and <ta> are returned only when <n>=1 and the ME is registered in the network. To know if the ME is registered use the AT+CREG command. If the ME is not registered in the cellular network an ERROR message is returned.

<n>	*Description*
0	Disable network location information unsolicited result code. **Default value**
1	Enable network location information unsolicited result code *E2CD: <lac>,<ci>,<ta>

<lac>	*Description*
String type	Two byte location area code in hexadecimal format

<ci>	*Description*

string type	Two byte cell ID in hexadecimal format

<ta>	*Description*
0-63	According to GSM 04.18 V8.6.0, the coding of the timing advance value is the binary representation of the timing advance in bit periods; 1 bit period = 48/13 is. <ta> is the integer representation of the timing advance in binary format
64-255	Reserved

14.2 *AT*E2EMM Ericsson M2M Engineering Monitoring Mode*

Description	*Command*	*Possible Responses*
Set the response presentation mode	AT*E2EMM=<n>[,<m>]	• ERROR • OK
Display mode neighbour cells are taken from the toplist		*E2EMM: Serving Cell MCC,MNC,LAC,CellID,BSIC,Ch[,RxL,C1,C2][,RxLFull,RxLSub,RxQFull,RxQSub,TA,TN], <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>[,<rxl>,<c1>,<c2>][,<rxlFull>,<rxlSub>,<rxqfull>,<rxqsub>,<ta>,<tn>], NeighBours Cells MCC,MNC,LAC,CellID,BSIC,Ch,RxL[,C1,C2], <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] … <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] OK
Compact mode. The first cell is the serving cell, the rest are neighbour cells taken from the toplist		*E2EMM: <mcc>,<mnc>,<ci>, <bsic>,<ch>[,<rxl>][,<rxlSub>,<rxqsub>, <ta>],<mcc>,<mnc>,<ci>,<bsic>,<ch>, <rxl>, <mcc>,<mnc>,<ci>,<bsic>,<ch>,<rxl>, … <mcc>,<mnc>,<ci>,<bsic>,<ch>,<rxl> OK
Verbose mode. The first cell is the serving cell and the rest are neighbour cells as provided by the network in the system info. messages (2 and 5) and via the AT*E2NBTS command		*E2EMM: <mcc>,<mnc>,<lac>, <ci>,<bsic>,<ch>[,<rxl>,<c1>,<c2>] [,<rxlFull>,<rxlSub>,<rxqfull>,<rxqsub>, <ta>,<tn>], <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] … <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[,<c1>,<c2>] OK

Reduced display mode - info. as display mode but without text headings or <CR><LF> separators, neighbour cells from top list		*E2EMM: <mcc>,<mnc>,<lac>, <ci>,<bsic>,<ch>[,<rxl>,<c1>,<c2>] [,<rxlFull>,<rxlSub>,<rxqfull>,<rxqsub>, <ta>,<tn>], <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[, <c1>,<c2>] <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[, <c1>,<c2>] … <mcc>,<mnc>,<lac>,<ci>,<bsic>,<ch>,<rxl>[, <c1>,<c2>] OK
Show the current setting	AT*E2EMM?	• *E2EMM: <n> • ERROR
Show if the command is supported	AT*E2EMM=?	• *E2EMM: (list of supported <n>s),(list of supported <m>s) • ERROR

Description:

There are four presentation format modes (Display, Compact, Verbose, and Reduced Display) and two response types (one shot response or continuous unsolicited responses).

The purpose of the presentation format mode Display is to display the data in a readable form, including headers and line breaks (<CR><LF>). This format is, however, not well suited for machine decoding. The formats Verbose, Compact and Reduced Display do not have headers or line breaks. Verbose mode displays more parameters than the compact mode.

The response types give the user the choice of one a shot information or an unsolicited response with <m> seconds between each response.

Examples

AT*E2EMM=1
*E2EMM:
Serving Cell
MCC,MNC,LAC,CellId,BSIC,Ch,RxL,C1,C2
234,15,0016,0D91,2E,0081,-085,00019,00019
Neighbour Cells
MCC,MNC,LAC,CellId,BSIC,Ch,RxL,C1,C2
000,00,0016,4047,3A,0083,-103,00001,00001
000,00,0016,423C,3A,0065,-104,00000,00000
000,00,0016,2F21,21,0067,-104,00000,00000
000,00,0016,8E3D,34,0077,-104,00000,00000
000,00,0016,348A,10,0091,-104,00000,00000

OK

AT*E2EMM=3

*E2EMM: <servcell mcc>,<servcell mnc>,<servcell ci>,
<servcell bsic>,<servcell ch>[,<servcell rxl>][,<servcell rxlSub>,
<servcell rxqsub>,<servcell ta>],<neighborcell1 mcc>,
<neighborcell1 mnc>,<neighborcell1 ci>,<neighborcell1 bsic>,
<neighborcell1 ch>,<neighborcell1 rxl>,<neighborcell2 mcc>,
<neighborcell2 mnc>,<neighborcell2 ci>,<neighborcell2 bsic>,
<neighborcell2 ch>,<neighborcell2 rxl>,
…
<neighborcelln mcc>,<neighborcellnmnc>,<neighborcellnci>,
<neighborcelln bsic>,<neighborcelln ch>,<neighborcelln rxl>
<CR><LF>
OK

AT*E2EMM=5

*E2EMM: <servcell mcc>,<servcell mnc>,<servcell lac>,
<servcell ci>,<servcell bsic>,<servcell ch>[,<servcell rxl>,
<servcell C1>,<servcell C2>][,<servcell rxlFull>,<servcell
rxlSub>,
<servcell rxqfull>,<servcell rxqsub>,<servcell tn>,<servcell ta>],
<neighborcell1 mcc>,<neighborcell1 mnc>,<neighborcell1 lac>,
<neighborcell1 ci>,<neighborcell1 bsic>,<neighborcell1 ch>,
<neighborcell1 rxl>[,<neighborcell1 C1>,<neighborcell1 C2>],
<neighborcell2 mcc>,<neighborcell2 mnc>,<neighborcell2 lac>,
<neighborcell2 ci>,<neighborcell2 bsic>,<neighborcell2 ch>,
<neighborcell2 rxl>[,<neighborcell2 C1>,<neighborcell2 C2>],
…
<neighborcelln mcc>,<neighborcellnmnc>,<neighborcelln lac>,
<neighborcelln ci>,<neighborcelln bsic>,<neighborcelln ch>,
<neighborcelln rxl>[,<neighborcelln C1>,<neighborcelln C2>]
<CR><LF>
OK

AT*E2EMM=7

*E2EMM:<servcell mcc>,<servcell mnc>,<servcell lac>,
<servcell ci>,<servcell bsic>,<servcell ch>[,<servcell rxl>,
<servcell c1>,<servcell c2>][,<servcell rxlFull>,<servcell
rxlSub>,
<servcell rxqfull>,<servcell rxqsub>,<servcell ta>,<servcell tn>],
<neighborcell1 mcc>,< neighborcell1 mnc>,<neighborcell1 lac>,
<neighborcell1 ci>,<neighborcell1 bsic>,<neighborcell1 ch>,
<neighborcell1 rxl>[,< neighborcell1 c1>,<neighborcell1 c2>],
<neighborcell2 mcc>,<neighborcell2 mnc>,<neighborcell2 lac>,
<neighborcell2 ci>,<neighborcell2 bsic>,<neighborcell2 ch>,
<neighborcell2 rxl>[,<neighborcell2 c1>,<neighborcell2c2>]
…
<neighborcelln mcc>,<neighborcelln mnc>,<neighborcelln lac>,
<neighborcelln ci>,<neighborcelln bsic>,<neighborcelln ch>,

<neighborcelln rxl>[,<neighborcelln c1>,<neighborcelln c2>]
OK

The mode setting <n> in the set command has the combination listed in the table below.

When <n>=5, the shot information is the same as in <n>=1, but neighbouring cells, which have to be up to 16. This is the information that comes from the Serving Cell through the BCCH, reporting the BTS that are on the Serving Cell's surroundings.

<n>	*Description*
0	Disable network monitoring unsolicited result code. **Default value**
1	One shot presentation of the network location information. Display mode with headers and <CR><LF> line separators
2	Enable network location information unsolicited result code in Display mode (like n=1). There will be continuous unsolicited information responses <m> seconds apart
3	One shot presentation of the compact network location information
4	Enable compact network location information unsolicited result code. There will be continuous unsolicited information responses <m> seconds apart
5	One shot presentation of the network location information (verbose format), including 16 BTSs, coming from the Serving Cell signalling information
6	As n=5 format but there will be continuous unsolicited information responses <m> seconds apart
7	One shot presentation of the network information (same information as in n=1) but no headers or <CR><LF> line separators. Neighbour cells from the Toplist
8	As n=7 format but there will be continuous unsolicited information responses <m> seconds apart

<m>	*Description*
1-255	Integer type giving time (in seconds) between unsolicited responses. **Default value is 5**

<mcc>	*Description*
Integer type	Three digits in decimal format. The Mobile Country Code identifies the PLMN serving cell country according to ITU

<mnc>	*Description*
Integer type	Two digits in decimal format. The Mobile Network Code identifies the PLMN operator in the serving cell

<lac>	*Description*
Integer type	Two byte location area code in hexadecimal format

<ci>	*Description*
Integer type	Two byte cell ID in hexadecimal format

<bsic>	*Description*
Integer type	One byte Base Stations Identification code in hexadecimal format

<ch>	*Description*
(0-1023)	It represents the ARFCN that shows the Absolute RF Channel, which identifies the BCCH carrier

<rxl>	*Description*
Integer type	Received Signal Strength level in dBm measured on idle mode

<rxlfull>	*Description*
Integer type	Received Signal Strength level in dBm. The Rx Level is taken in the Downlink and statistically is applied to 100 TDMA frames of the TCH or during a SACCH multiframe

<rxlsub>	*Description*
Integer type	Received Signal Strength level in dBm. The Rx Level is taken from the DownLink signal and the average is applied to subset of SACCH frames

<rxqfull>	*Description*
0	BER < 0.1 %
1	0.26 % < BER < 0.30 %
2	0.51 % < BER < 0.64 %
3	1.0 % < BER < 1.3 %
4	1.9 % < BER < 2.7 %
5	3.8 % < BER < 5.4 %
6	7.6 % < BER < 11.0 %
7	BER > 15.0 %

<mcc>	*Description*
Integer type	Three digits in decimal format. The Mobile Country Code identifies the PLMN serving cell country according to ITU

<rxqsub> is the parameter that indicates the quality in the received signal on dedicated mode. The measurement average is applied to a subset of a SACCH multiframe.

<rxqsub>	*Description*
0	BER < 0.1 %
1	0.26 % < BER < 0.30 %
2	0.51 % < BER < 0.64 %
3	1.0 % < BER < 1.3 %
4	1.9 % < BER < 2.7 %
5	3.8 % < BER < 5.4 %
6	7.6 % < BER < 11.0 %
7	BER > 15.0 %

<c1>	*Description*
Integer	Path Loss criterion parameter for neighbour cells. The MS calculates this parameter, in idle mode, to decide if the cell is suitable to camp on. After the calculation the criterion is C1 > 0. See GSM 05.08

<c2>	*Description*
Integer	Cell reselection parameter for neighbour cells. This parameter shall optimise the selected cell reselection

<ta>	*Description*
0-63	According to GSM 04.18 V8.6.0, the coding of the timing advance value is the binary representation of the timing advance in bit periods; 1 bit period = 48/13uS. <ta> is the integer representation of the timing advance in binary format
64-255	Reserved

<tn>	*Description*
0-7	Its value indicates the time slot number in a traffic channel

14.3 *AT*E2SPN M2M Service Provider Name*

Description	*Command*	*Possible Responses*
Request service provider indication	AT*E2SPN	• *E2SPN: <spi> • +CME ERROR: <err>
Show if the command is supported	AT*E2SPN=?	• OK • ERROR

Description:

Causes the MS to return the service provider name stored in the SIM card (<spi> parameter). The text will consist of a maximum of 16 bytes containing the service provider name stored in the EF_{SPN} file in the SIM card (see GSM 11.11). ERROR is returned if the field is not present on the SIM.

<spi>	*Description*
String	String type field of maximum length 16 bytes; character set as specified by command Select TE character set +CSCS

14.4 *AT*EALS Ericsson Request ALS Status*

Description	*Command*	*Possible Responses*
Requests current status for ALS	AT*EALS	• *EALS: <status> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EALS=?	• +CME ERROR: <err> • OK • ERROR

Description:

Used to request the MS to give ALS (Alternate Line Services) status. The information is available on the SIM card. If ALS is active, the user has two lines for voice calls. The line number or name tag for the line is then indicated on the display.

<status>	*Description*
0	ALS function is not active (off)
1	ALS function is active (on)

14.5 *AT*ECSP Ericsson Customer Service Profile*

Description	*Command*	*Possible Responses*
Read the customer service profile from the SIM	AT*ECSP=<service group>	• *ECSP: <service group>,<services> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ECSP=?	• +CME ERROR: <err> • OK • ERROR

Description:

This command is used to read the customer service profile (CSP) from the SIM. CSP is a list on the SIM, which indicates the services that are user accessible. Each of the services has a related bit within the CSP. The services are grouped into service groups, with a maximum of 8 services in a group. For each service group, a bit mask tells which services are available (bit=1). Unused bits are set to 0.

<service group>	*Description*
Byte	Each service group has a corresponding number, service group code

<services>	*Description*
byte	Bit mask (8 bits), indicating the services within the service group Bit=0: unused or unavailable service Bit=1: available service

14.6 *AT*EPNR Ericsson Read SIM Preferred Network*

Description	*Command*	*Possible Responses*
Read entries in SIM preferred list	AT*EPNR=<format> [,<index1> [,<index2]]	• *EPNR: <index1>,<oper1>[...]* EPNR: <index2>, <oper2> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EPNR=?	• *EPNR: (list of supported <index>s), (list of supported <format>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command is used to read the SIM preferred list of networks ($EF_{PLMNSEL}$).

<index1>	*Description*
integer	Start index (>0)

<index2>	*Description*
integer	Stop index (>0)

<format>	*Description*
2	Numeric <oper>

<oper>	*Description*
string	String indicates the code for the operator. E.g. GSM - Sweden - Europolitan: “24008” (3 + 2). PCS: 3 digits for country and 3 digits for network

Example!
```
AT*EPNR=2,1,10
*EPNR: 1,“24008”
*EPNR: 2,“20404”
*EPNR: 3,“20810”
*EPNR: 4,“20205”
*EPNR: 5,“65501”
*EPNR: 6,“26203”
*EPNR: 7,“50503”
*EPNR: 8,“27201”
```

*EPNR: 9,“64101”
*EPNR: 10,“27801”

OK

14.7 *AT*EPNW Ericsson Write SIM Preferred Network*

Description	*Command*	*Possible Responses*
Write/delete entries in SIM preferred list	AT*EPNW=[<index>] [,<format>,<oper>]	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EPNW=?	• *EPNW: (list of supported <index>s), (list of supported <format>)s • +CME ERROR: <err> • OK • ERROR

Description:

This command is used to edit the SIM preferred list of networks ($EF_{PLMNSEL}$). The entry field <oper> contains mobile country code (MCC) and mobile network code (MNC).

<index>	*Description*
Integer	Index to entry in SIM preferred list. The SIM preferred list contains at least 8 positions according to GSM 11.11

<format>	*Description*
2	Numeric <oper>

<oper>	*Description*
String	String indicates the code for the operator. E.g. GSM – Sweden - Europolitan: “24008” (3 + 2). PCS: 3 digits for country and 3 digits for network

14.8 *AT*E2SSN Ericsson M2M SIM Serial Number*

Description	*Command*	*Possible Responses*
Request SIM Serial number	AT*E2SSN	<SSN>
Shows if the command is supported	AT*E2SSN=?	• OK • ERROR

Description:

This command requests the SIM serial number held in the ICCid field (address 2FE2) on the SIM and returns all valid characters to the TE. This field is detailed in GSM 11.11 section 10.1.1.

<SSN>	*Description*
String without double quotes	SIM serial number

Examples

AT*E2SSN
8944110063503224707
OK

where the raw data contained in the ICCid field on the SIM is 98441100360523420 7F7.

Test command:

AT*E2SSN=?
OK

14.9 *AT*ESLN Ericsson Set Line Name*

Description	*Command*	*Possible Responses*
Sets the line name tag in the MS	AT*ESLN=<line> [,<name>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ESLN?	• *ESLN: <line1>,<name1><CR><LF> *ESLN: <line2>,<name2> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESLN=?	• *ESLN: (list of supported <line>s),<lname> • +CME ERROR: <err> • OK • ERROR

Sets the name tag for a selected line.

<line>	*Description*
0	This means that the two lines will use the default name tags, i.e. “L1” and “L2”. **Default value**
1	Line 1
2	Line 2

<name>	*Description*
String	Characters for name tag This parameter is optional when <line> is set to 0

<lname>	*Description*
Integer	Maximum number of characters to use in <name> string (20)

14.10 *AT+CIMI Subscriber Identification*

Description	*Command*	*Possible Responses*
Read IMSI	AT+CIMI	• <IMSI> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CIMI=?	• OK • ERROR

Causes the TA to return <IMSI>, identifying the individual SIM attached to the ME.

<IMSI>	*Description*
string without double quotes	International Mobile Subscriber Identity

Example! AT+CIMI
234157411545420

OK

14.11 *AT+CLCK Facility Lock*

Description	*Command*	*Possible Responses*
Request facility lock	AT+CLCK=<fac>, <mode>[,<passwd> [,<class>]]	• when <mode>=2 and command successful: +CLCK: <status>[,<class1> [<CR><LF>+CLCK: <status>,<class2>[...]] • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CLCK=?	• +CLCK: (list of supported <fac>s) • +CME ERROR <err> • OK

Description:

The command is used to lock, unlock or interrogate an ME or a network facility <fac>. A password is normally needed to carry out such actions.

Call barring facilities are based on GSM supplementary services (refer to GSM 02.88). The interaction of these, with

other commands based on other GSM supplementary services, is described in the GSM standard.

<fac>	*Description*
“PS”	PH-SIM (lock PHone to SIM card) (ME asks password when other than current SIM card inserted)
“SC”	SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued)
“P2”	SIM PIN2
“AO”	BAOC (bar all outgoing calls)
“OI”	BOIC (bar outgoing international calls)
“AI”	BAIC (bar all incoming calls)
“IR”	BIC-Roam (bar incoming calls when roaming outside the home country)
“OX”	BOIC-exHC (bar outgoing international calls except to home country)
“AB”	All barring services
“AG”	All out going barring services
“AC”	All in coming barring services
“FD”	SIM fixed dialling feature. SIM2 is required as a password
“PN”	Network personalization
“PU”	Network subset personalization
“PP”	Service provider personalization
“PC”	Corporate personalization

<mode>	*Description*
0	Unlock
1	Lock
2	Query status
10	Full lock (only valid for <fac>=“PS”, after power on always ask for password)

<status>	*Description*
0	Not active
1	Active

<passw>	*Description*
string type	Is the same as password specified for the facility from the ME user interface or with change password command, +CPWD

<classx>	*Description*
1	Voice L1
2	Data
4	Fax
8	Short message service
16	Data circuit sync
32	Data circuit async
64	Dedicated packet access
128	Voice L2
1..30	When “no reply” is enabled or queried, this gives the time in seconds to wait before the call is forwarded. **Default value is 20**

14.12 *AT+CNUMSubscriber Number*

Description	*Command*	*Possible Responses*
Request subscriber number	AT+CNUM	• +CNUM: [<alpha1>],<number1>,<type1> [,<speed>,<service>[,<itc>]][<CR><LF>+CNUM: [<alpha2>],<number2>,<type2> [,<speed>,<service> [,<itc>]][…]] • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CNUM=?	• +CME ERROR: <err> • OK • ERROR

Description:

This command returns the MSISDNs related to the subscriber (this information can be stored in the SIM or in the ME). If subscriber has different MSISDN for different services, each MSISDN is returned in a separate line.

<alphax>	*Description*
Alphanumeric string	Associated with <number*x*>; used character set should be the one selected with the Select TE character set command,

	+CSCS

<numberx>	*Description*
String type	ME number of format specified by <type*x*>

<typex>	*Description*
Integer format	Type of address, (refer to GSM 04.08 subclause 10.5.4.7)

<speed>	*Description*
data rate	As defined in subclause 6.7 GSM 07.07

<service>	*Description*
0	Asynchronous modem
4	Voice
5	Fax

<itc>	*Description*
0	3.1 kHz
1	UDI

14.13 *AT+COLP Connected Line Identification Presentation*

Description	*Command*	*Possible Responses*
Request connected line identification presentation	AT+COLP=[<n>]	• OK • ERROR
Show the current setting	AT+COLP?	• +COLP: <n>,<m> • OK • ERROR
Show if the command is supported	AT+COLP=?	• +COLP: (list of supported <n>s) • OK • ERROR

Description:

This command refers to the GSM/UMTS supplementary service COLP (Connected Line Identification Presentation) that enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile originated call. The command enables or disables the presentation of the COL at the TE. It has no effect on the execution of the supplementary service COLR in the network.

When enabled (and allowed by the called subscriber), +COLP: <number>,<type>[,<subaddr>,<satype> [,<alpha>]] intermediate result code is returned from the TA to the TE before any +CR or V.25ter responses. It is manufacturer specific if this response is used when normal voice call is established.

Read command gives the status of <n>, and also triggers an interrogation of the provision status of the COLP service according 3GPP TS 22.081 (given in <m>).

Test command returns values supported by the TA as a compound value.

<n>	*Description*
0	Disable
1	Enable

<m>	*Description*
0	COLP not provisioned
1	COLP provisioned
2	unknown (e.g. no network, etc.)

Intermediate Result codes:

+COLP: <number>,<type>[,<subaddr>,<satype> [,<alpha>]]

14.14 *AT+COPN* *Read Operator Names*

Description	Command	Possible Responses
Request operator selection	+COPN=?	+COPN: <numeric1>,<alpha1> [<CR><LF>+COPN: <numeric2>,<alpha2> [...]] *+CME ERROR: <err>*

	OK
	ERROR

Description:

Command returns the list of operator names from the ME. Each operator code <numericn> that has an alphanumeric equivalent <alpha*n*> in the ME memory shall be returned. This command can return several hundred names and can execute for up to 90 seconds..

Defined values:

<numericn>: string type; operator in numeric format.

<alphan>: string type; operator in long alphanumeric format.

14.15 *AT+COPS Operator Selection*

Description	*Command*	*Possible Responses*
Request operator selection	AT+COPS=[<mode>[,<format>[,<oper>]]]	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+COPS?	• +COPS: <mode>[,<format>,<oper>] • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+COPS=?	• +COPS: list of supported (<stat>,long alphanumeric <oper>, short alphanumeric <oper>,numeric <oper>)s • +CME ERROR <err> • OK • ERROR

Description:

Forces an attempt to select and register the GSM network operator.

<mode>	*Description*
0	Automatic (<oper> field is ignored)
1	Manual (<oper> field present)
3	Set only <format> (for read command +COPS?), do not attempt registration/de-registration (<oper> field is ignored); this value is not applicable in read command response

4	Manual/automatic (<oper> field present); if manual selection fails, automatic mode (<mode>=0) is entered

<format>	*Description*
0	Automatic (<oper> field is ignored)
2	Numeric <oper>

<oper>	*Description*
string type	Format determined by the <format> setting

<stat>	*Description*
0	Unknown
1	Available
2	Current
3	Forbidden

Example! AT+COPS=?
+COPS: (2,“UK VODAFONE”,“UK Vodafone”,“23415”)
+COPS: (3,“UK Orange PCS Ltd”,“Orange”,“23433”)
+COPS: (3,“T-Mobile UK”,“T-Mobile UK”,“23430”)
+COPS: (3,“O2 - UK”,“O2 - UK”,“23410”)

OK

14.16 *AT+CPOL Preferred Operator List*

Description	*Command*	*Possible Responses*
Request operator selection	+CPOL=[<index>][, <format>[,<oper>]]	*+CME ERROR: <err>* • OK ERROR
Shows the current setting	+CPOL?	+CPOL: <index1>,<format>,<oper1> [<CR><LF>+CPOL: <index2>,<format>,<oper2> [...]] *+CME ERROR: <err>* • OK ERROR
Show if the command is supported	+CPOL=?	+CPOL: (list of supported <index>s),(list of supported <format>s)*+CME ERROR: <err>* • OK ERROR

Description:

This command is used to edit the SIM preferred list of networks. Execute command writes an entry in the SIM list of preferred operators ($EF_{PLMNsel}$). If <index> is given but <oper> is left out, entry is deleted. If <oper> is given but <index> is left out, <oper> is put in the next free location. If only <format> is given, the format of the <oper> in the read command is changed

Note! ME may also update this list automatically when new networks are selected.

Read command returns all used entries from the SIM list of preferred operators.

Test command returns the whole index range supported by the SIM.

<index>	*Description*
1-n	integer type; the order number of operator in the SIM preferred operator list (value range returned by test command)

<format>	*Description*
0	long format alphanumeric <oper>
1	short format alphanumeric <oper>
2	numeric <oper>

<oper>	*Description*
string type	Format determined by the <format> setting

14.17 *AT+CREG Network Registration*

Description	*Command*	*Possible Responses*
Request network registration	AT+CREG=[<n>]	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CREG?	• +CREG: <n>,<stat> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CREG=?	• +CREG: (list of supported <n>s) • +CME ERROR <err> • OK

	• ERROR

Description:

Set command controls the presentation of an unsolicited result code +CREG: <stat> when <n>=1 and there is a change in the ME network registration status.

Read command returns the status of result code presentation and an integer <stat>, which shows whether the network has currently indicated the registration of the ME.

Controls the presentation of the unsolicited result code +CREG.

<n>	*Description*
0	Disable network registration unsolicited result code. **Default value**
1	Enable network registration unsolicited result code

<stat>	*Description*
0	Not registered, ME is not currently searching for a new operator to register with
1	Registered, home network
2	Not registered, but ME is currently searching for a new operator to register with
3	Registration denied
4	Not detailed
5	Registered, roaming

Example! AT+CREG?
+CREG: 0,1

OK

14.18 *AT*ECPI Ciphering Indicator*

Description	*Command*	*Possible Responses*
Request activation of the ciphering indication	AT*ECPI=<switch>	• OK • +CME: <error> • ERROR

Shows the current setting	AT*ECPI?	• *ECPI: <switch> • OK • ERROR
Show if the command is supported	AT*ECPI=?	• *ECPI: (list of supported <switch>es values) • OK • ERROR

Description:

This command allows the external application to activate/deactivate the ciphering indication. The ciphering indication allows the external application to detect when the mobile connection becomes deciphered and thus unsecured.

Test command gives the current value of the <switch> parameter, informing if the indicator is enabled or disabled.

The ciphering indicator feature may be disabled by the home network operator setting data in the “administrative data” field (EFAD) in the SIM as defined in GSM 11.11.

If this feature is not disabled by the SIM, then whenever a connection is in place, which is or becomes deciphered, an indication is given via the unsolicited result code *ECPV:<ciphering>.

<switch>	*Description*
1	Ciphering indication is on. The unsolicited result code *ECPV is sent anytime the communication is unsecured and when it becomes secure again
0	Ciphering indication is off. Disable the ciphering indication, *ECPV is not sent

Unsolicited Result Codes:

*ECPV: <ciphering>. Sent only when <switch> is set to 0.

Unsolicited Result Codes

*ECPV - Ciphering Indicator

SYNTAX - Unsolicited Result code

Description	*Response*	*When*
Set command informs the TE when a communication is unsecured due to the fact that the network is not enciphering the communication	*ECPV: <ciphering>	When AT*ECPI enables it, the *ECPV:<ciphering> is sent during a connection whenever the communication is not enciphered. If a connection becomes secure after that, the *ECPV:<ciphering> is sent again to indicate that

	now the communication is enciphered

<ciphering>	*Description*
0	The connection is secured. The network enciphers the communication
1	The connection is unsecured. The network does not encipher the communication

14.19 *AT*E2NBTS Ericsson M2M Neighbour BTS*

Description	*Command*	*Possible Responses*
Set Neighbour Cells to monitor	AT*E2NBTS=<ch1>,<bsic1>[,<ch2>,<bsic2>[,<ch3>,<bsic3>[,<ch4>,<bsic4>[,<ch5>,<bsic5>[,<ch6>,<bsic6>[,<ch7>,<bsic7>[,<ch8>,<bsic8>[,<ch9>,<bsic9>[,<ch10>,<bsic10>[,<ch11>,<bsic11>[,<ch12>,<bsic12>[,<ch13>,<bsic13>[,<ch14>,<bsic14>[,<ch15>,<bsic15>[,<ch16>,<bsic16>]]]]]]]]]]]]]]]	• ERROR • OK
Show the current setting	AT*E2NBTS?	• *E2NBTS: <mcc>,<mnc>,<ci>,<bsic>,<ch>,<rxl><CR><LF> <mcc>,<mnc>,<ci>,<bsic>,<ch>,<rxl><CR><LF> … <mcc>,<mnc>,<ci>,<bsic>,<ch>,<rxl><CR><LF> <CR><LF> • OK • ERROR
Show if the command is supported	AT*E2NBTS=?	• *E2NBTS: (list of supported <ch>s) • ERROR

Description:

The set command shall provide with the ARFCNs (<ch>) and the BSIC (the BSIC is a cell colour code) to the MS in order to monitor those channels, belonging to the neighbour cells, instead of the ones that come through the air interface, in the serving cell information broadcast channel.

It is possible to update that information with up to 16 neighbour cells. If less than 16 <ch>s are provided, then the assigned

channels shall substitute the last previous channel (given either by the BCCH or by another AT*E2NBTS command), if it is not in the list yet. Therefore, <ch1>,<bsic1> will substitute BTS 16 in the MS, <ch2>,<bsic2> to the BTS 15 and so on. If any of the <ch>s is already in the top-list, then it is skipped.

The read command displays the data of every neighbour cell, including the following parameters: MCC, MNC, Cell ID, BSIC, Channel and Rx Level.

<ch>	*Description*
(0-1023)	It represents the ARFCN that shows the Absolute RF Channel, which identifies a BCCH carrier

<mcc>	*Description*
String Type	Three digits in decimal format. The Mobile Country Code identifies the PLMN serving cell country according to ITU

<mnc>	*Description*
String Type	Two digits in decimal format. The Mobile Network Code identifies the PLMN operator in the serving cell

<ci>	*Description*
String type	Two byte cell ID in hexadecimal format

<bsic>	*Description*
String Type	One byte Base Stations Identification code in hexadecimal format

<rxl>	*Description*
String Type	Received Signal Strength level in dBm, measured in idle mode

14.20 *AT*ESRT SIM Reset Timeout*

Description	*Command*	*Possible Responses*
Set SIM Reset timeout time	AT*ESRT=<time>	• OK • ERROR
Read current setting	AT*ESRT?	• *ESRT: <time> • OK • ERROR
Test if the command is supported	AT*ESRT=?	• *E2SDR: (list of supported <time>s) • OK • ERROR

Description:

This command sets the timeout time between an attention request sent to the SIM card and when a response is expected. If the time times out, there will be a SIM reset. The default value should be fine, unless the external SIM interface is used and the cable is long (causing a delay).

The report setting is persistent, and will remain after a power cycle.

<time>	*Description*
13	Timeout time in ms. **Default.**
14-1000	Timeout time in ms.

15 Phonebook

15.1 *AT*E2PBCS Ericsson M2M Phonebook Check Sum*

Description	*Command*	*Possible Responses*
Request phonebook checksum	AT*E2PBCS	• *E2PBCS: <cks> • +CME ERROR: <err>
Show if the command is supported	AT*E2PBCS=?	• OK • ERROR

Description:

Command causes the ME to return the phonebook checksum <cks> stored internally. phonebook checksum is recalculated whenever there is a change in the phonebook. By requesting the checksum, the external application can detect if the phonebook in the ME has changed, without downloading the whole phonebook.

During the SIM initialisation process, it takes some time to download the phonebook from the SIM card to the ME, depending on the number of entries. In case the command is invoked before the checksum has been calculated, the ME gives an ERROR message.

<cks>	*Description*
Hex type	1 byte in hexadecimal (between “”), containing the checksum

15.2 *AT*ESAG Ericsson Add to Group*

Description	*Command*	*Possible Responses*
Adds a new item to the group with <gindex>	AT*ESAG=<gindex>, <type>, <itemindex>	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESAG=?	• *ESAG: (list of supported <gindex>s, list of supported <type>s • OK • ERROR

Description:

This command adds a contact or a ME number to the current group.

<gindex>	*Description*
1-10	The group index within the hierarchical phonebook

<type>	*Description*
1	Contact
2	ME number

<itemindex>	*Description*
Integer	The index of the contact/group/ME number to add. The <itemindex> parameter has the following meaning: if the item to add is a contact, the <itemindex> is the index of the contact in the contacts book. If the item to add is a ME number the <itemindex> is the index in the phonebook

15.3 *AT*ESCG Ericsson Create Group*

Description	*Command*	*Possible Responses*
Adds a new group to the hierarchical phonebook	AT*ESCG=<name>	• +CME ERROR: <err> • OK • ERROR
Shows if the command is supported	AT*ESCG=?	• *ESCG: <maxnamelength> • +CME ERROR: <err> • OK • ERROR

Description:

This command creates a new group in the hierarchical phonebook. The group is stored at the first available position. There are 10 group positions in the hierarchical phonebook.

<name>	*Description*
String	The group name. Character set as specified by command Select TE Character Set (AT+CSCS)

<maxnamelength>	*Description*

integer	The maximum length of the grouping (bytes)

15.4 *AT*ESCN Ericsson Set Credit Card Number*

Description	*Command*	*Possible Responses*
Set up a credit card number	AT*ESCN=<mode> [,<passwd>][,<indexn>] [,<asn>,<type>,<name>,<vercode>[,<send order>]]	• +CME ERROR: <err> when mode=3:*ESCN: <indexn>,<asn>,<type>, <name>,<vercode>, <send order> When mode=4:*ESCN: <selindexn> • OK • ERROR
Show if the command is supported	AT*ESCN=?	• *ESCN: (list of supported <index>s),(list of supported <mode>s),(list of supported <send order>s) • +CME ERROR: <err> • OK • ERROR

Description:

Command is used to:

- set up a credit card number in the ME.
- disable credit card calls.
- enable one of the credit card call services.
- query the settings for one of the services.
- query the active credit call access server.

<mode>	*Description*
0	Settings for a credit card call (<passwd>, <indexn>, <asn>,<type>,<name>,<vercode> [,<send order>]). The four (4) parameters (<passwd>, <indexn>, <asn>, <vercode>) are mandatory when <mode>=0. If all those are not submitted ERROR will be returned
1	Disable credit card calling (<passwd>). If any other parameters are submitted, they are ignored
2	Enable one of the credit card call services (<passwd>, <indexn>). If any other parameters are submitted, they are ignored
3	Query (<passwd>, <indexn>). If any other parameters are submitted, they are ignored
4	Query for the selected credit call access server. If any parameters are submitted, they are ignored

<passwd>	*Description*
String	character string, ME lock code “PS”, PH-SIM

<indexn>	*Description*
1	Index number to the first credit card call access server
2	Index number to the second credit card call access server

<selindexn>	*Description*
0	Credit card calling disabled
1	Index number to the first credit card call access server
2	Index number to the second credit card call access server

<asn>	*Description*
String	Character string <0..9,+>, max. 20 characters ME number of format specified by <type*x*>

<type>	*Description*
Integer format	Type of address

<name>	*Description*
String	Character string of the name tag, for M&M. Maximum of 18 characters

<vercode>	*Description*
String	Character string <0..9,#,*>. Maximum of 20 characters

<send order>	*Description*
1	Verification code first. **Default value**
2	ME number to call first

15.5 *AT*ESVM Ericsson Set Voice Mail Number*

Parameter Command Syntax:

Description	*Command*	*Possible Responses*
Set voice mail number	AT*ESVM<line>,<index>,<onoff>[,<number>[,<type>]]	• +CME ERROR: <err>
Show the current setting	AT*ESVM?	• *ESVM:<line1>,<index1>,<onoff1>,<number1>,<type1><CR><LF>*ESVM:<line1>,<index2>,<onoff2>,<number2>,<type1><CR><LF>*ESVM:<line2>,<index1>,<onoff1>,<number1>,<type1><CR><LF>*ESVM:<line2>,<index2>,<onoff2>,<number2>,<type1><CR><LF>· • +CME: <err>
Show if the command is supported or not	AT*ESVM=?	• *ESVM(list of supported<line>s), (list of supported<index>es), (list of supported<onoff>s), <nlength>, (list of supported <type>s) • +CME: <err>

Description:

The number to the voice mail server is set with this command. L1 can have two voice mail numbers and if ALS is active, L2 can have two voice mail numbers. The numbers can be different or the same. One number, index 1, is for the home network and the other, index 2, is for roaming. The unit changes voice mail number automatically.

The parameters <number> and <type> can be left out if the parameter <onoff> is set to 0.

Abortability:

This command may not be aborted.

<index>	*Description*
1	Home network voice mail number
2	Roaming voice mail number

<line>	*Description*
1	Line 1

2	Line 2

<onoff>	*Description*
0	Disable the voice mail number. Not Supported
1	Enable the voice mail number.

<number>	*Description*
String	Character string<0 …. 9,+>

<type>	*Description*
Integer format	Type of address octet(refer to GSM 04.08 section 10.5.4.7)
129	ISDN / telephony numbering plan, national / international unknown
145	ISDN / telephony numbering plan, international number
161	ISDN / telephony numbering plan, national number
128 - 255	Other values refer to GSM 04.08 section 10.5.4.7

<nlength>	*Description*
Integer type	Value indicating the maximum length of field <number>

Example! ESVM means Ericsson Set Voice Mail; this means that the purpose of the command is for and only for setting the voice mail box server number. The command has no other function it was and never was intended to dial the voice mail number that is set on the SIM.

So for Vodafone the command would need the following procedure:

AT*EVSM=? // test if command is present
At*ESVM? //Read voice mail number
*ESVM: 1,253,"447787xxxxxx",144

OK

Now to dial this you would need to dial ATD121; for Vodafone.

15.6 *AT*ESDG Ericsson Delete Group*

Description	*Command*	*Possible Responses*
Deletes a group defined in the hierarchical phonebook	AT*ESDG=<gindex>	• +CME ERROR: <err> • OK
Show if the command is supported	AT*ESDG=?	• *ESDG: list of <gindex>s • OK

Description:

This command deletes the group at position <gindex> from the hierarchical phonebook.

<gindex>	*Description*
1-10	The group index

15.7 *AT*ESDI Ericsson Delete Group Item*

Description	*Command*	*Possible Responses*
Deletes the item in group <gindex> with position <index>	AT*ESDI=<gindex>,<index>	• +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESDI=?	• +CME ERROR: <err> • OK • ERROR

Description:

The command deletes the item with <index> in the group with <gindex>.

<gindex>	*Description*
1-10	The groups index within the hierarchical phonebook

<index>	*Description*
1-15	The items index within the group

15.8 *AT*ESGR Ericsson Group Read*

Description	*Command*	*Possible Responses*
Lists the groups defined in the hierarchical phonebook	AT*ESGR	• *ESGR: <gindex1>, <name1>[<CR><LF> <gindex2>, <name2>..] • OK • ERROR
Shows if the command is supported	AT*ESGR=?	OK

Description:

This command lists the groups in the hierarchical phonebook.

<gindex>	*Description*
1-10	The group index

<name>	*Description*
String	The group name

15.9 *AT*EGIR Ericsson Group Item Read*

Description	*Command*	*Possible Responses*
Lists the items in the <gindex> group	AT*EGIR=<gindex>	• *EGIR: <index1>, <type1>,<itemindex> [<CF><LF><index2>, <type2>, <itemindex> [...]] • OK • ERROR
Show if the command is supported	AT*EGIR=?	• OK • ERROR

Description:

This command lists the items stored in the group identified by <gindex>.

<gindex>	*Description*
1-10	The groups index within the hierarchical phonebook

<index>	*Description*
1-15	The items index within the group

<type>	*Description*
Integer	The kind of item. See AT*ESAG <item> table for definition

<itemindex>	*Description*
Integer	The item's index within the phonebook/contacts/group

15.10 *AT*ESIL Ericsson Silence Command*

Description	*Command*	*Possible Responses*
Sets the MS to silent mode	AT*ESIL=[<mode>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ESIL?	• *ESIL: <mode> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESIL=?	• *ESIL: (list of supported <mode>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command orders the ME to be in silent mode. When the ME is in silent mode, all sounds from the MS are prevented.

<mode>	*Description*
0	Silent mode off. **Default value**
1	Silent mode on

15.11 *AT*ESNU Ericsson Settings Number*

Description	*Command*	*Possible Responses*
Sets a number in the MS	AT*ESNU=<type>, <number>[,<number type>]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ESNU?	• *ESNU: <type 1>, <number 1>, <number type 1> <CR><LF> ….*ESNU: <type n>, <number n>, <number type n> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*ESNU=?	• *ESNU: (list of supported <type>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command sets a <type> number, in the format <number type>, in the MS.

<type>	*Description*
0	Voice L1
1	Voice L2
2	Fax
3	Data

<number type>	*Description*
129	Default value when dialling string does not include the international access code character ‘+’
145	Default value when dialling string includes the international access code character ‘+’

<number>	*Description*
0-9, +	Number

15.12 *AT+CPBF Phonebook Find*

Description	*Command*	*Possible Responses*
Show the current setting	+CPBF=<findtext>	• +CPBF: <index1>,<number>,<type>,<text>[[...]<CR><LF>+CBPF: <index2>,<number>,<type>,<text>] • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	+CPBF=?	• +CPBF: <nlength>,<tlength> • +CME ERROR: <err> • OK • ERROR

Description:

Returns phonebook entries whose alphanumeric field starts with <findtext>. Only currently selected source will be searched for,

<findtext>	*Description*
string type	Field of maximum length <tlength>; character set as specified by the select TE character set command, +CSCS

15.13 *AT+CPBR Phonebook Read*

Description	*Command*	*Possible Responses*
Read phonebook entries	+CPBR=<index1> [,<index2>]	• +CPBR:<index1>,<number>, <type>,<text>[[,<text_date>, <text_time>]<CR><LF>+CPBR: <index2>,<number>,<type>, <text>[,<text_date>, <text_time>]] • +CME ERROR <err> • OK • ERROR
Show if the command is supported	+CPBR=?	• +CPBR: (list of supported <index>s),<nlength>,<tlength> • +CME ERROR <err> • OK • ERROR

Description:

Returns phonebook entries in location number range <index1>... <index2> from the current phonebook memory storage selected with +CPBS. If <index2> is left out, only location <index1> is returned. Entry fields returned are location number <indexn>, ME number stored there <number> (of format <type>) and text <text> associated with the number.

<indexn>	*Description*
integer type	Values in the range of location numbers of phonebook memory

<number>	*Description*
string type	ME number of format <type>

<type>	*Description*
129	ISDN/telephony numbering plan, national/international unknown
145	ISDN/telephony numbering plan, international number
161	ISDN/telephony numbering plan, national number
128 - 255	Other values refer to GSM 04.08 section 10.5.4.7

<text>	*Description*
string type	Field of maximum length <tlength>; character set as specified by the select TE character set command, +CSCS.

<nlength>	*Description*
integer type	Value indicating the maximum length of field <number>

<tlength>	*Description*
integer type	Value indicating the maximum length of field <text>

Example! AT+CPBR=1,99
+CPBR: 1,“44123456789”,145,“Test Number”
+CPBR: 2,“440987654321”,145,“Test number 2”
+CPBR: 3,“449876543210”,129,“Test Number 3”

OK

15.14 *AT+CPBS ME Storage*

Description	*Command*	*Possible Responses*
Set phonebook storage	AT+CPBS=<storage> [,<password>]	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CPBS?	• +CPBS: <storage> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CPBS=?	• +CPBS: (list of supported <storage>s) • +CME ERROR <err> • OK • ERROR

Description:

Selects phonebook memory storage <storage>, which is used by other phonebook commands. Read command returns currently selected memory, and when supported by manufacturer, number of used locations and total number of locations in the memory.

<storage>	*Description*
“EN”	Emergency numbers
“ME”	ME phonebook
“SM”	SIM phonebook
“DC”	ME dialled calls list (30 entries)
“RC”	ME received calls list (30 entries)
“MC”	ME missed calls list (30 entries)

<passwd>	*Description*
String type	Represents the password required when selecting password protected <storage>s.

15.15 *AT+CPBWPhonebook Write*

Description	*Command*	*Possible Responses*
Request phonebook write	AT+CPBW=[<index>] [, <number>[,<type> [,<text>]]]	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CPBW=?	• +CPBW: (list of supported <index>s),<nlength>,(list of supported <type>s),<tlength> • +CME ERROR <err> • OK • ERROR

Description:

Writes phonebook entry in location number <index> in the current phonebook memory storage area, selected with AT+CPBS. If the <number> and <text> parameters are omitted, the entry is deleted. If <index> is omitted but <number> is included, the entry is written to the first free location in the phonebook.

<index>	*Description*
integer type	Values in the range of location numbers of phonebook memory

<number>	*Description*
string type	ME number of format <type>

<type>	*Description*
integer format	Type of address octet, default 145 when dialing string includes international access code character “+”, otherwise 129. (refer to GSM 04.08 subclause 10.5.4.7)
129	ISDN/telephony numbering plan, national/international unknown
145	ISDN/telephony numbering plan, international number
161	ISDN/telephony numbering plan, national number
128-255	Other values refer GSM 04.08 section 10.5.4.7

<text>	*Description*

string type	Field of maximum length <tlength>; character set as specified by the select TE character set command, +CSCS

<nlength>	*Description*
integer type	Value indicating the maximum length of field <number>

<tlength>	*Description*
integer type	Value indicating the maximum length of field <text>

Example! AT+CPBW=1,“44123456789”,145,“Test Number”

OK

AT+CPBW=2,“440987654321”,145,“Test number 2”

OK

AT+CPBW=3,“449876543210”,129,“Test Number 3”

OK

16 Short Message Services - Point to Point

16.1 *AT+CGSMS Select Service for MO SMS Messages*

See 6.10, AT+CGSMS Select Service for MO SMS Messages

16.2 *AT+CPMSPreferred Message Storage*

Common for both PDU (Protocol Data Unit) and Text Modes

Description	*Command*	*Possible Responses*
Set preferred message storage	AT+CPMS=<mem1> [,<mem2>] [,<mem3>]	• +CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> • +CMS ERROR: <err> • OK • ERROR
Show the current setting	AT+CPMS?	• +CPMS: <mem1>,<used1>,<total1, <mem2>,<used2>,<total2, <mem3>,<used3>,<total3> • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CPMS=?	• +CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s) • OK • ERROR

Description:

Selects memory storage <mem1>, <mem2> and <mem3> to be used for reading, writing, etc. If chosen storage is not appropriate for the ME (but is supported by the TA), final result code +CMS ERROR: <err> is returned.

Test command returns lists of memory storage supported by the TA.

<mem1>	*Description*
string type	Memory from which messages are read and deleted (commands List Messages +CMGL, Read Message +CMGR and Delete Message +CMGD)
“ME”	ME message storage

“SM”	SIM message storage. **Default value**

<mem2>	*Description*
string type	Memory to which writing and sending operations are made (commands Send Message from Storage +CMSS and Write Message to Memory +CMGW)
“ME”	ME message storage
“SM”	SIM message storage

<mem3>	*Description*
string type	Memory to which received SMSs are preferred to be stored (unless forwarded directly to TE). Received CBMs are always stored in “BM” (or some manufacturer specific storage) unless directly forwarded to TE
“ME”	ME message storage
“SM”	SIM message storage

<used1>,<used2>,<used3>	*Description*
integer type	Total number of messages currently in <mem1>, <mem2> and <mem3> respectively

<total1>,<total2> ,<total3>	*Description*
integer type	Total number of message locations in <mem1>, <mem2> and <mem3> respectively

Note! If the command is entered in at power up and the unit has not finished loading the messages the unit will return +CMS ERROR: 98 (busy).

Examples

```
AT+CPMS=?
+CPMS: (“ME”,“SM”),(“ME”,“SM”),(“ME”,“SM”)

OK

AT+CPMS?
+CPMS: “ME”,0,40,“SM”,1,15,“ME”,0,40

OK

AT+CPMS=“sm”,“sm”,“sm”
+CPMS: 1,15,1,15,1,15
```

OK

16.3 *AT+CSCA Service Centre Address*

Common for both PDU and Text Modes

Description	*Command*	*Possible Responses*
Set service centre address	AT+CSCA=<sca> [,<tosca>]	• OK • ERROR
Show the current setting	AT+CSCA?	• +CSCA: <sca>,<tosca> • OK • ERROR
Show if the command is supported	AT+CSCA=?	• OK • ERROR

Description:

Updates the SMSC address, through which mobile originated SMs are transmitted. In text mode, the setting is used by send (+CMGS) and write (+CMGW) commands. In PDU mode, the setting is used by the same commands, but only when the length of the SMSC address coded into <pdu> parameter equals zero. Note that a “+” in front of the number in <sca> has precedence over the <tosca> parameter, so that a number starting with “+” will always be treated as an international number.

<sca>	*Description*
string type	GSM 04.11 (3G TS 24.011) RP SC address Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character set

<tosca>	*Description*
integer type	GSM 04.11 (3G TS 24.011) RP SC address type-of-address octet in integer format
129	ISDN/telephony numbering plan, national/international unknown
145	ISDN/telephony numbering plan, international number
161	ISDN/telephony numbering plan, national number
128-255	Other values refer GSM 04.08 section 10.5.4.7

Example! AT+CSCA?
+CSCA: “44385016005”,145

OK

16.4 *AT+CMGF Message Format*

Common for both PDU and Text Modes

Description	*Command*	*Possible Responses*
Set message format	AT+CMGF=<mode>	• OK • ERROR
Show the current setting	AT+CMGF?	• +CMGF: <mode> • OK • ERROR
Show if the command is supported	AT+CMGF=?	• +CMGF: (list of supported <mode>s) • OK • ERROR

Description:

This command tells the TA, which input and output format to use for messages. The <mode> parameter indicates the format of messages used with send, list, read and write commands, and unsolicited result codes resulting from received messages. Mode can be either PDU mode (entire TP data units used) or text mode (headers and body of the messages given as separate parameters).

Test command returns supported modes as a compound value.

<mode>	*Description*
0	PDU mode
1	Text mode

16.5 *AT+CMGW Write Message to Memory*

PDU Mode

Description	*Command*	*Possible Responses*
Write message to memory	AT+CMGW=<length>[,<stat>]<CR>***PDU is given***<ctrl-Z/ESC>	• +CMGW: <index> • +CMS ERROR: <err> • OK • ERROR

Show if the command is supported	AT+CMGW=?	• OK • ERROR

Description:

Stores a message to memory storage <mem2>. Memory location <index> of the stored message is returned. By default message status will be set to 'stored unsent', but parameter <stat> allows other status values to be given. ME/TA manufacturer may choose to use different default <stat> values for different message types. Entering PDU is the same as specified by the send message command, +CMGS. If writing fails, final result code +CMS ERROR: <err> is returned. See AT+CPMS Preferred Message Storage, page 198.

<stat>	*Description*
2	Stored unsent message (only applicable to SMs)

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<pdu>	*Description*
...	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 TPDU in hexadecimal format

Text Mode

Description	*Command*	*Possible Responses*
Write message to memory	AT+CMGW [=<oa/da> [,<tooa/toda>[,<stat>]]] <CR> ***Text is entered*** <ctrl-Z/ESC>	• +CMGW: <index> • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGW=?	• OK • ERROR

Description:

Stores message (either SMS-DELIVER or SMS-SUBMIT) to memory storage <mem2>. Memory location <index> of the stored message is returned. By default message status will be set to 'stored unsent', but parameter <stat> allows also other status values to be given. The entering of text is done as specified in the send message command, +CMGS. If writing fails, final result code +CMS ERROR: <err> is returned.

Note! SMS-COMMANDs and SMS-STATUS-REPORTs cannot be stored in text mode.

<stat>	*Description*
2	Stored unsent message (only applicable to SMs)

<oa>	*Description*
String type	GSM 03.40 TP-Originating-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <tooa>

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<tooa>	*Description*
String type	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

16.6 *AT+CMGS Send Message*

PDU Mode

Description	*Command*	*Possible Responses*
Send message	AT+CMGS=<length> <CR> ***PDU is given***<ctrl-Z/ESC>	• +CMGS: <mr>[,<ackpdu>] • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGS=?	• OK • ERROR

Description:

Sends a message from a TE to the network (SMS-SUBMIT). Message reference value <mr> is returned to the TE on successful message delivery. Optionally, when AT+CSMS <service> value is 1 and there is network support, <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable.

- <length> must indicate the number of octets coded in the TP layer data unit to be given (i.e. SMSC address octets are excluded).
- The TA shall send a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after command line is terminated with <CR>; after that PDU can be given from TE to ME/TA.
- The DCD signal is in the ON state as PDU is given.
- The echoing of given characters back from the TA is controlled by V.25ter echo command E.
- The PDU shall be hexadecimal format (similarly as specified for <pdu>) and given in one line; ME/TA converts this coding into the actual octets of PDU.
- When the length octet of the SMSC address (given in the <pdu>) equals zero, the SMSC address set with command Service Centre Address +CSCA is used.
- Sending can be cancelled by giving <ESC> character (IRA 27).
- <ctrl-Z> (IRA 26) must be used to indicate the ending of PDU

<mr>	*Description*

Integer type	GSM 03.40 TP-Message-Reference in integer format

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<ackpdu>	*Description*
...	GSM 03.40 RP-User-Data element of RP-ACK PDU; format is same as for <pdu> in case of SMS, but without GSM 04.11 SC address field and parameter shall be bounded by double quote characters like a normal string type parameter

Text Mode

Description	*Command*	*Possible Responses*
Send message	AT+CMGS=<da> [,<toda>] <CR> ***Text is entered***<ctrl-Z/ESC>	• +CMGS: <mr>[,<scts>] • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGS=?	• OK • ERROR

Description:

Sends a message from a TE to the network (SMS-SUBMIT). Message reference value <mr> is returned to the TE on successful message delivery. Optionally, when AT+CSMS <service> value is 1 and there is network support, <scts> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable.

- The entered text (GSM 03.40 TP-Data-Unit) is sent to address <da> and all current settings (refer Set Text Mode Parameters +CSMP and Service Centre Address +CSCA) are used to construct the actual PDU in the ME/TA.
- The TA shall send a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after the command line is terminated with <CR>; after that text can be entered from the TE to the ME/TA.
- The DCD signal is in the ON state as text is entered.
- The echoing of entered characters back from the TA is controlled by V.25ter echo command E.

- The entered text should be formatted as follows:

if <dcs> (set with +CSMP) indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set:

if TE character set other than “HEX” (refer command Select TE Character Set +CSCS in TS 07.07): ME/TA converts the entered text into GSM alphabet according to rules of Annex A; backspace can be used to delete last character and carriage returns can be used (previously mentioned four character sequence shall be sent to the TE after every carriage return entered by the user);

if TE character set is “HEX”: the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts to 7-bit characters of GSM alphabet (e.g. 17 (IRA 49 and 55) will be converted to character Π (GSM 23));

if <dcs> indicates that 8-bit or UCS2 data coding scheme is used or <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is set: the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts into 8-bit octet (e.g. two characters 2A (IRA 50 and 65) will be converted to an octet with integer value 42).

- Sending can be cancelled by giving <ESC> character (IRA 27).
- <ctrl-Z> (IRA 26) must be used to indicate the ending of the message body

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

Note! In GSM there are two types of numbers 129, which are national and 145 which are international.

<mr>	*Description*
String type	GSM 03.40 TP-Service-Centre-Time-Stamp in time-string format (refer <dt>)

.

<scts>	*Description*
Integer	GSM 03.40 TP-Message-Reference

Example!
```
AT+CMGF=1
OK
 AT+CSMP=17,167,0,0
OK
AT+CMGS="+447747008670"
> Test SMS
+CMGS: 15

OK
```

16.7 *AT+CMSSSend From Storage*

PDU mode

Description	*Command*	*Possible Responses*
Send from storage	AT+CMSS=<index>	• +CMSS: <mr> • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMSS=?	• OK • ERROR

Description:

Sends message with location value <index> from message storage <mem2> to the network (SMS-SUBMIT or SMS-COMMAND). Reference value <mr> is returned to the TE on successful message delivery. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable. See AT+CPMS Preferred Message Storage, page 198.

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<mr>	*Description*
Integer type	GSM 03.40 TP-Message-Reference in integer format

Text Mode

Description	*Command*	*Possible Responses*
Send from storage	AT+CMSS=<index> [,<da> [,<toda>]]	• +CMSS: <mr> [,<scts>] • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMSS=?	• OK • ERROR

Description:

Sends message with location value <index> from message storage <mem2> to the network (SMS-SUBMIT or SMS-COMMAND). Reference value <mr> is returned to the TE on successful message delivery. Optionally, when +CSMS <service> value is 1 and network supports, <scts> is returned. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable.

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

Note! Note In GSM there are two types of numbers 129, which are national and 145 which are international.

<scts>	*Description*
String type	GSM 03.40 TP-Service-Centre-Time-Stamp in time-string format (refer <dt>)

<mr>	*Description*
Integer type	GSM 03.40 TP-Message-Reference in integer format

16.8 *AT+CMGC Send Command*

PDU Mode

Description	*Command*	*Possible Responses*
Send command message	AT+CMGC=<length><CR> <pdu><ctrl-Z/ESC>	• if PDU mode (+CMGF=0) and sending successful: +CMGC: <mr>[,<ackpdu>] • if sending fails: +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGC=?	• OK • ERROR

Description:

Sends a command message from a TE to the network (SMS-COMMAND). The entering of PDU is as specified in the send message command, +CMGS. Message reference value <mr> is returned to the TE on successful message delivery. Optionally (when +CSMS <service> value is 1 and network supports) <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable.

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<pdu>	*Description*
String	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 TPDU in hexadecimal format

<mr>	*Description*
Integer type	GSM 03.40 TP-Message-Reference in integer format

<ackpdu>	*Description*

String	GSM 03.40 RP-User-Data element of RP-ACK PDU; format is same as for <pdu> in case of SMS, but without GSM 04.11 SC address field and parameter shall be bounded by double quote characters like a normal string type parameter

Text Mode

Description	*Command*	*Possible Responses*
Send command message	AT+CMGC=<fo>,<ct>[,<pid>[,<mn>[,<da>[,<toda>]]]] <CR> ***Text is entered***<ctrl-Z/ESC>	• if PDU mode (+CMGF=1) and sending successful: +CMGC: <mr>[,<scts>] • if sending fails: +CMS ERROR: <err> • OK • ERROR
Show if the commands is supported	AT+CMGC=?	• OK • ERROR

Description:

Sends a command message from a TE to the network (SMS-COMMAND). The entering of text is as specified in the send message command, +CMGS, but the format is fixed to be a sequence of two IRA character long hexadecimal numbers, which the ME/TA converts into 8-bit octets (refer to +CMGS). Message reference value <mr> is returned to the TE on successful message delivery. Optionally, when +CSMS <service> value is 1 and there is network support, <scts> is returned. Values can be used to identify message upon unsolicited delivery status report result code. If sending fails in a network or an ME error, final result code +CMS ERROR: <err> is returned. This command is abortable.

<fo>	*Description*
0	First octet of SMS-DELIVER in integer format
1	First octet of SMS_SUBMIT in integer format
2	First octet of SMS-STATUS-REPORT in integer format
3	First octet of SMS-COMMAND in integer format

<ct>	*Description*
Integer	GSM 03.40 TP-Command-Type. **Default value is 0**

<pid>	*Description*

0-255	Protocol Identifier in integer format. **Default value is 0**, according to 07.05 section 9.2.3.9

<mn>	*Description*
Integer	GSM 03.40 TP-Message-Number

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

Note! Note In GSM there are two types of numbers 129, which are national and 145 which are international.

<mr>	*Description*
Integer type	GSM 03.40 TP-Message-Reference in integer format

<scts>	*Description*
String type	GSM 03.40 TP-Service-Centre-Time-Stamp in time-string format (refer to <dt>)

16.9 *AT+CNMI New Message Indications to TE*

PDU Mode

Description	*Command*	*Possible Responses*
Set new message indication to TE	AT+CNMI=[<mode> [,<mt>[,<bm>[,<ds>]]]]	• +CMS ERROR: <err> • OK • ERROR
Show the current setting	AT+CNMI?	• +CNMI: <mode>,<mt>,<bm>,<ds>,<bfr> • OK • ERROR
Show if the command is supported	AT+CNMI=?	• +CNMI: (list of supported <mode>s), (list of supported <mt>s), (list of supported <bm>s), (list of supported <ds>s), (list of supported <bfr>s

	• OK • ERROR

Description:

Selects the procedure for the way in which new messages received from the network, are indicated to the TE when it is active, e.g. DTR signal is ON. If the TE is inactive (DTR signal is OFF), message receiving is carried out as specified in GSM 03.38 (3G TS 23.038).

If the command fails and the error is related to mobile equipment or network, the final result code CMS ERROR: <err> is returned.

<mode>	*Description*
3	Forward unsolicited result codes directly to the TE. TA-TE link specific inband technique used to embed result codes and data when TA is in on-line data mode

<mt>	*Description*
0	No SMS-DELIVER indications are routed to the TE. No class, Class 0, class 1 and class 3 use <mem3> as preferred storage. Class 2 messages shall be stored in the SIM. If it this is not possible then the MS shall send an error message accordingly to GSM 03.38
1	SMS-DELIVER is stored into ME/TA and the indication of the memory location is routed to the TE using unsolicited result code: +CMTI: <mem>,<index>
2	Class 0, class 1, and class 3 SMS-DELIVERs are routed directly to the TE using the unsolicited result code but not stored in ME/TA: +CMT:[<alpha >], <length><CR><LF><pdu> (PDU mode enabled) Class 2 data coding scheme result in indication as defined in <mt>=1
3	Class 3 SMS-DELIVERs are routed directly to TE using unsolicited result codes +CMT: <length><CR><LF><pdu>. Class 3 SMS-DELIVER is not stored in ME/TA. Messages of other data coding schemes result in indication as defined in <mt>=1

<bm>	*Description*
0	Store message to “BM” (or some manufacturer specific memory). No CBM indications are routed to the TE
2	New CBMs are routed directly to the TE using unsolicited

	result code: +CBM: <length><CR><LF><pdu> (PDU mode enabled). New CBMs are not stored in CBM memory

<ds>	*Description*
0	No SMS-STATUS-REPORTs are routed to the TE. SMS-STATUS-REPORT is stored in ME/TA
1	SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDS: < length>< CR>< LF>< pdu> (PDU mode enabled). SMS-STATUS-REPORT is not stored in ME/TA
2	SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDSI: < mem><index> (PDU mode enabled). SMS-STATUS-REPORT is stored in ME/TA

<bfr>	*Description*
0	TA buffer of unsolicited result codes defined within this command is flushed to the TE when <mode> 1...3 is entered (OK response shall be given before flushing the codes).

Unsolicited Result codes:

+CMT: <length><CR><LF><pdu>
+CMTI: <mem>,<index>
+CBM: <length><CR><LF><pdu>
+CDS: <length><CR><LF><pdu>
+CDSI: <mem><index>

Text Mode

Description	*Command*	*Possible Responses*
Set new message indication to TE	AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>]]]]	• +CMS ERROR: <err> • OK • ERROR
Show the current setting	AT+CNMI?	• +CNMI: <mode>,<mt>,<bm>,<ds> • OK • ERROR
Show if the command is supported	AT+CNMI=?	• +CNMI: (list of supported <mode>s), (list of supported <mt>s), (list of supported <bm>s), (list of supported <ds>s) • OK • ERROR

Description:

Selects the procedure for the way in which new messages received from the network, are indicated to the TE when it is active, e.g. DTR signal is ON. If TE is inactive (DTR signal is OFF), message receiving is carried out as specified in GSM 03.38 (3G TS 23.038).

If the command fails and the error is related to mobile equipment or network, the final result code CMS ERROR: <err> is returned.

<mode>	*Description*
3	Forward unsolicited result codes directly to the TE. TA-TE link specific inband technique used to embed result codes and data when TA is in on-line data mode

<mt>	*Description*
0	No SMS-DELIVER indications are routed to the TE. No class, Class 0, class 1 and class 3 use <mem3> as preferred storage. Class 2 messages shall be stored in the SIM. If it this is not possible then the MS shall send an error message accordingly to GSM 03.38
1	SMS-DELIVER is stored into ME/TA and the indication of the memory location is routed to the TE using unsolicited result code: +CMTI: <mem>,<index>
2	Class 0, class 1, and class 3 SMS-DELIVERs are routed directly to the TE using the unsolicited result code: +CMT:<oa>, [<alpha>, <scts> [,<tooa>,<fo>,<pid>,<dcs>, <sca>,<tosca>,<length>]<CR><LF><data> (text mode enabled). About parameters in italics, refer to the show text mode command, +CSDH
3	Class 3 SMS-DELIVERs are routed directly to TE using unsolicited result codes +CMT:<oa>, [<alpha>, <scts> [,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF> <data> (Text Mode enabled). About parameters in italics, refer to the show text mode command, +CSDH. Messages of other data coding schemes result in indication as defined in <mt>=1

<bm>	*Description*
0	Store message to “BM” (or some manufacturer specific memory). No CBM indications are routed to the TE
2	New CBMs are routed directly to the TE using unsolicited result code: +CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> (Text mode enabled)

<ds>	*Description*
0	No SMS-STATUS-REPORTs are routed to the TE
1	SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: : +CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> (Text mode enabled). SMS-STATUS-REPORT is not stored in ME/TA
2	SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDSI: < mem><index> (Text mode enabled). SMS-STATUS-REPORT is stored in ME/TA

Unsolicited Result codes:

+CMT:<oa>, [<alpha>, <scts>
[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF>
<data> (Text Mode enabled). Refer to the show text mode command, +CSDH for information on the parameters in italics.
+CMTI: <mem>,<index>
+CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data>
+CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>
+CDSI: <mem><index>

Example! Display cell broadcast messages:

AT+CNMI=3,0,2,0,0

16.10 *AT+CMGR Read Message*

PDU Mode

Description	*Command*	*Possible Responses*
Read message	AT+CMGR= <index>	• +CMGR: <stat>,[<alpha>],<length> <CR><LF><pdu> • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGR=?	• OK • ERROR

Description:

Returns message with location value <index> from preferred message storage <mem1> to the TE. Status of the message and entire message data unit <pdu> is returned. If status of the message is ‘received unread’, status in the storage changes to ‘received read’. If reading fails, final result code +CMS ERROR: <err> is returned.

<stat>	*Description*
0	Received unread message (i.e. new message)
1	Received read message
2	Stored unsent message (only applicable to SMs)
3	Stored sent message (only applicable to SMs)

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<alpha>	*Description*
String type	Manufacturing specific. Should be left empty but not omitted

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<pdu>	*Description*
	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 TPDU in hexadecimal format

Note! It is possible to send SMS in PDU mode, if help for this is required then please contact customer support.

Note! Prior to the R6 build of software the unit was only able to read upto 30 messages on a SIM, messages in locations over 30 could not be seen or access. In R6 this has been increased to 100.

Text Mode

Description	*Command*	*Possible Responses*
Read message	AT+CMGR= [<index>]	• if text mode (+CMGF=1), command successful and SMS-DELIVER: +CMGR: <stat>,<oa>,[<alpha>],<scts>,[<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>, <length>]<CR><LF><data> • if text mode (+CMGF=1), command

		successful and SMS-SUBMIT: +CMGR: <stat>,<da>,[<alpha>],*[<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]*<CR><LF><data> • if text mode (+CMGF=1), command successful and SMS-STATUS-REPORT: +CMGR: <stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> • if text mode (+CMGF=1), command successful and SMS-COMMAND: +CMGR: <stat>,<fo>,<ct>*[,<pid>,[<mn>],[<da>],[<toda>],<length><CR><LF><cdata>]* • if text mode (+CMGF=1), command successful and CBM storage: +CMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> • +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGR=?	• OK • ERROR

Description:

Returns messages with location index <index> from message storage <mem1> to the TE. About text mode parameters in Italics, refer command Show Text Mode Parameters (+CSDH), If the status of the message is ‘received unread’, status in the storage changes to ‘received read’. If listing fails final result code +CMS ERROR: <err> is returned.

<index>	*Description*
Integer type	Value in the range of location numbers supported by <mem1>

<stat>	*Description*
0	Received unread message (new message)
1	Received read message
2	Stored unsent message (only applicable to SMs)
3	Stored sent message (only applicable to SMs)

<oa>	*Description*
String type	GSM 03.40 TP-Originating-Address Value in string format;

	BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <tooa>

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

<tooa>	*Description*
String type	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)

<tora>	*Description*
String type	GSM 04.11 TP-Recipient-Address Type-of-Address octet in integer format (default refer <toda>)

<alpha>	*Description*
String type	Manufacturing specific. Should be left empty but not omitted, i.e. commas shall mark the place were it should be. Used character set should be the one selected with command Select TE Character Set +CSCS

<scts>	*Description*
String type	GSM 03.40 TP-Service-Centre-Time-Stamp in time-string format (refer <dt>)

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<data>

The entered text should be formatted as follows:

if <dcs> (set with +CSMP) indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set:

if TE character set other than "HEX" (refer command Select TE Character Set +CSCS in TS 07.07): ME/TA converts the entered text into GSM alphabet according to rules of Annex A; backspace can be used to

delete last character and carriage returns can be used (previously mentioned four character sequence shall be sent to the TE after every carriage return entered by the user);

if TE character set is "HEX": the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts to 7-bit characters of GSM alphabet (e.g. 17 (IRA 49 and 55) will be converted to character Π (GSM 23));

if <dcs> indicates that 8-bit or UCS2 data coding scheme is used or <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is set: the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts into 8-bit octet (e.g. two characters 2A (IRA 50 and 65) will be converted to an octet with integer value 42);

sending can be cancelled by giving <ESC> character (IRA 27)

<ctrl-Z> (IRA 26) must be used to indicate the ending of the message body

<fo>	*Description*
0	First octet of SMS-DELIVER in integer format
1	First octet of SMS_SUBMIT in integer format
2	First octet of SMS-STATUS-REPORT in integer format
3	First octet of SMS-COMMAND in integer format

<mr>	*Description*
Integer	GSM 03.40 TP-Message_Reference

<ra>	*Description*
String type	GSM 03.40 TP-Recipient-Address-Value field. BCD (or GSM default alphabet) are converted to characters of the currently selected TE character set (refef command +CSCS. Type of address given by <tosca>

<dt>	*Description*
String type	GSM 03.40 TP-Discharge-Time in string format “yy/mm/dd,hh:mm:ss±zz where characters indicate year, month, day, hour,minutes, seconds and time zone

<st>	*Description*
Integer	GSM 03.40 TP-status

<ct>	*Description*
Integer	GSM 03.40 TP—command-type. **Default value is 0**

<sn>	*Description*
Integer	GSM 03.41 CBM serial number

<mid>	*Description*
String type	All different possible combinations of CBM message identifiers (refer <mid>) (default is empty string); e.g. “0,1,5-7” <mid> GSM 03.41 CBM message identifier in integer format

<page>	*Description*
Integer format	GSM 03.41 CBM page parameter bits 4-7 in integer format

<pages>	*Description*
Integer type	GSM 03.41 CBM page parameter bits 0-3 in integer format

<pid>	*Description*
0 – 255	Protocol Identifier in integer format. **Default value is 0**, according to 07.05 section 9.2.3.9

<dcs>	*Description*
0 - 255	Data coding scheme. See GSM 03.48. **UCS2 and compressed text not supported**

<sca>	*Description*
String type	GSM 04.11 RP SC address Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character set

<tosca>	*Description*
Integer type	GSM 04.11 RP SC address type-of-address octet in integer format
129	ISDN/telephony numbering plan, national/international unknown
145	ISDN/telephony numbering plan, international number
161	ISDN/telephony numbering plan, national number
128 – 255	Other values refer to GSM 04.08 section 10.5.4.7

<vp>	*Description*

0 - 143	(TP-VP+1) x 5 minutes (i.e. 5 minute intervals up to 12 hous)
144 - 167	12 hours + ((TP_VP-143) x 30 minutes)
168 - 196	(TP-VP-166) x 1 day
197 - 255	(TP-VP-192) x 1 week

<mn>	*Description*
Integer type	GSM 03.40 TP-message-number

Note! Prior to the R6 build of software the unit was only able to read upto 30 messages on a SIM, messages in locations over 30 could not be seen or access. In R6 this has been increased to 100.

16.11 *AT+CMGL List Message*

PDU Mode

Description	*Command*	*Possible Responses*
List message	AT+CMGL [=<stat>]	• +CMGL: <index>,<stat>,[<alpha>],<length> <CR><LF><pdu>[<CR><LF> +CMGL: <index>,<stat>,[<alpha>],<length> <CR><LF><pdu>[…]] • +CMS ERROR: <err>
Show if the command is supported	AT+CMGL=?	• +CMGL: (list of supported <stat>s)

Note! Returns messages with status value <stat> from preferred message storage <mem1> to the TE. Entire data units <pdu> are returned. If status of the message is ‘received unread’, status in the storage changes to ‘received read’. If listing fails, final result code +CMS ERROR: <err> is returned.

<stat>	*Description*
0	Received unread message (i.e. new message)
1	Received read message
2	Stored unsent message (only applicable to SMs)
3	Stored sent message (only applicable to SMs)
4	All messages (only applicable to +CMGL command)

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<alpha>	*Description*
String type	Manufacturing specific. Should be left empty but not omitted

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<pdu>	*Description*
	In the case of SMS: GSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format: ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: GSM 03.41 TPDU in hexadecimal format

Text Mode

Description	*Command*	*Possible Responses*
List message	AT+CMGL =[<stat>]	• If text mode (+CMGF=1), command successful and SMS-SUBMITs and SMS-DELIVERs: +CMGL: <index1>,<stat>,<oa/da>,[<alpha>],[<scts>][,<tooa/toda>,<length>] <CR><LF><data>[<CR><LF> +CMGL: <index2>,<stat>,<oa/da>,[<alpha>],[<scts>][,<tooa/toda>,<length>] <CR><LF><data>[...]] • If text mode (+CMGF=1), command successful and SMS-STATUS-REPORT: +CMGL: <index1>,<stat>,<fo>,<mr>, [<ra>],[<tora>],<scts>,<dt>,<st> [<CR><LF> +CMGL: <index2>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>[...]] • If text mode (+CMGF=1), command successful and SMS-COMMANDs: +CMGL: <index>,<stat>,<fo>,<ct> [<CR><LF> +CMGL: <index>,<stat>,<fo>,<ct>[...]]

		• If text mode (+CMGF=1), command successful and CBM storage: +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages>,<CR><LF><data>[<CR><LF> +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><CR><LF> <data>[...]] • Otherwise: +CMS ERROR: <err>
Show the current setting	AT+CMGL?	• +CMGL:<stat> • +CMS ERROR: <err>
Show if the command is supported	AT+CMGL=?	• +CMGL: (list of supported <stat>s) • +CMS ERROR: <err>

Description:

Returns messages with status value <stat> from message storage <mem1> to the TE. About text mode parameters in Italics, refer command Show Text Mode Parameters (+CSDH). If the status, of the message is 'received unread', status in the storage changes to 'received read'. If listing fails final result code +CMS ERROR: <err> is returned.

<index>	*Description*
Integer type	Value in the range of location numbers supported by <mem1>

<stat>	*Description*
REC UNREAD	Received unread message (i.e. new message)
REC READ	Received read message
STO UNSENT	Stored unsent message (only applicable to SMs)
STO SENT	Stored sent message (only applicable to SMs)
ALL	All messages (only applicable to +CMGL command)

<oa>	*Description*
String type	GSM 03.40 TP-Originating-Address Value in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <tooa>

<da>	*Description*
String type	GSM 03.40 TP-Destination-Address Value in string format; BCD numbers (or GSM default alphabet characters) are

	converted to characters of the currently selected TE character (refer command +CSCS). Type of address given by <toda>

<toda>	*Description*
String type	GSM 04.11 TP-Destination- Address Type-of-Address octet in integer format (when first character of <da> is +(IRA 43) default is 145, otherwise default is 129

<tooa>	*Description*
String type	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)

<tora>	*Description*
String type	GSM 04.11 TP-Recipient-Address Type-of-Address octet in integer format (default refer <toda>)

<alpha>	*Description*
String type	Manufacturing specific. Should be left empty but not omitted i.e. commas shall mark the place were it should be. Used character set should be the one selected with command Select TE Character Set +CSCS

<scts>	*Description*
String type	GSM 03.40 TP-service-centre-time-stamp in time-string format (refer <dt>)

<length>	*Description*
Integer type	Value indicating in PDU mode (+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)

<data>

The entered text should be formatted as follows:

if <dcs> (set with +CSMP) indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set:

if TE character set other than "HEX" (refer command Select TE Character Set +CSCS in TS 07.07): ME/TA converts the entered text into GSM alphabet according to rules of Annex A; backspace can be used to delete last character and carriage returns can be used (previously mentioned four character sequence shall be sent to the TE after every carriage return entered by the user);

if TE character set is "HEX": the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts to 7-bit characters of GSM alphabet (e.g. 17 (IRA 49 and 55) will be converted to character Π (GSM 23));

if <dcs> indicates that 8-bit or UCS2 data coding scheme is used or <fo> indicates that GSM 03.40 TP-

User-Data-Header-Indication is set: the entered text should consist of two IRA character long hexadecimal numbers which ME/TA converts into 8-bit octet (e.g. two characters 2A (IRA 50 and 65) will be converted to an octet with integer value 42);
sending can be cancelled by giving <ESC> character (IRA 27)
<ctrl-Z> (IRA 26) must be used to indicate the ending of the message body

<fo>	*Description*
0	First octet of SMS-DELIVER in integer format
1	First octet of SMS_SUBMIT in integer format
2	First octet of SMS-STATUS-REPORT in integer format
3	First octet of SMS-COMMAND in integer format

<mr>	*Description*
Integer	GSM 03.40 TP-Message-Reference

<ra>	*Description*
String	GSM 03.40 TP-Recipient-Address-Value field. BCD (or GSM default alphabet) are converted to characters of the currently selected TE character set (refef command +CSCS. Type of address given by <tosca>

<dt>	*Description*
String	GSM 03.40 TP-Discharge-Time in string format "yy/MM/dd,hh:mm:ss+-zz where characters indicate year, month, day, hour,minutes, seconds and time zone

<st>	*Description*
Integer	GSM 03.40 TP-Status

<ct>	*Description*
Integer	GSM 03.40 TP-Command-Type (default 0)

<sn>	*Description*
Integer	GSM 03.41 CBM Serial Number

<mid>	*Description*
String type	All different possible combinations of CBM message identifiers (refer <mid>) (default is empty string); e.g. "0,1,5-7"

	<mid> GSM 03.41 CBM Message Identifier in integer format

<page>	*Description*
Integer format	GSM 03.41 CBM Page Parameter bits 4-7 in integer format

<pages>	*Description*
Integer format	GSM 03.41 CBM Page Parameter bits 0-3 in integer format

Example!
```
AT+CMGF=1
OK

AT+CMGL=?
+CMGL: “REC UNREAD”,“REC READ”,“STO UNSENT”,“STO
SENT”,“ALL”

OK
```

16.12 *AT+CMGD Delete Message*

Common for both PDU and Text modes

Description	*Command*	*Possible Responses*
Delete message	AT+CMGD=<index>, <delflag>	• +CMS ERROR: <err> • OK • ERROR
Show if the command is supported	AT+CMGD=?	• OK • ERROR

Description:

Deletes message from preferred message storage <mem1> location <index>. If <delflag> is present and not set to 0, the ME shall ignore <index> and act according to the definition of <delflag> in the table shown below. If <delflag> is omitted, only the entry in <index> will be deleted.

If deleting fails, final result code +CMS ERROR: <err> is returned. Test command shows the valid memory locations.

<index>	*Description*
Integer type	Value in the range of location numbers supported by the associated memory

<delflag>	*Description*
0	Delete the message specified in <index>. **Default.**
4	Delete all messages from preferred message storage including unread messages (ignore <index>)

16.13 *AT+CSDH Show Text Mode Parameters*

Only Applicable to Text Mode

Description	*Command*	*Possible Responses*
Set the show text mode	AT+CSDH=[<show>]	• +CME ERROR: <err> • OK
Show the current setting	AT+CSDH?	• +CSDH: <show> • +CME ERROR: <err>
Show if the command is supported	AT+CSDH=?	• +CSDH: (list of supported <show>s) • OK • +CME ERROR: <err>

Description:

Controls whether detailed header information is shown in text mode result codes

<show>	*Description*
0	Do not show header values defined in commands AT+CSCA and AT+CSMP (<sca>, <tosca>, <fo>, <vp>, <pid> and <dcs>) nor <length>, <toda> or <tooa> in +CMT, +CMGL, +CMGR result codes for SMS-DELIVERs and SMS-SUBMITs in text mode; for SMS-COMMANDs in +CMGR result code, do not show <pid>, <mn>, <da>, <toda>, <length> or <cdata>
1	Show the values in result codes

16.14 *AT+CSMP Set Text Mode Parameters*

Only Applicable to Text Mode

Description	*Command*	*Possible Responses*
Set the text mode parameters	AT+CSMP=[<fo>[,<vp>[,<pid>[,<dcs>]]]]	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CSMP?	• +CSMP: <fo>,<vp>,<pid>,<dcs> • +CME ERROR: <err>
Show if the command is	AT+CSMP=?	• +CSMP: (List of supported <fo>s), (list of supported <vp>s), (list of supported <pid>s), (list of

supported	supported <dcs>s) • +CME ERROR: <err> • OK • ERROR

Description:

Used to select values for additional parameters needed when SM is sent to the network or placed in a storage when text format message mode is selected. It is possible to set the validity period starting from when the SM is received by the SMSC (<vp> is in range 0… 255). The <pid> parameter identifies the higher protocol being used or indicates interworking with a certain type of telematic service and <dcs> determines the way the information is encoded as in GSM 03.38.

<fo>	*Description*
0-255	Depending on the command or result code: first octet of GSM 03.40 SMS-DELIVER, SMS-SUBMIT (default value 17),SMS-STATUS-REPORT, or SMS-COMMAND (default value 2) in integer format

<vp>	*Description*
0-143	(TP-VP+1) x 5 minutes (i.e 5 minutes intervals up to 12 hours)
144-167	12 hours + ((TP_VP-143) x 30 minutes)
168-196	(TP-VP-166) x 1 day
197-255	(TP-VP-192) x 1 week

<pid>	*Description*
0-255	Protocol Identifier in integer format. **Default value is 0**, according to 07.05 section 9.2.3.9

<dcs>	*Description*
0-255	Data coding scheme. See GSM 03.38. **UCS2 and compressed text not supported**

16.15 *AT+CSCS Select Character Set*

Description	*Command*	*Possible Responses*
Set command informs TA which character set is used by the TE	AT+CSCS=<chset>	• OK • ERROR
Show the current setting	AT+CSCS?	• +CSCS: <chset>

		• OK • ERROR
Show if the command is supported	AT+CSCS=?	• +CSCS: (list of supported <chset>s) • OK • ERROR

Description:

This command informs the TA which character set <chset> is used by the TE. The TA is then able to convert character strings correctly between TE and ME character sets.

When TA-TE interface is set to 8-bit operation and the used TE alphabet is 7-bit, the highest bit shall be set to zero.

Note! How the internal alphabet of ME is converted to, or from, the TE alphabet is manufacturer specific.

Note! If writing an ENAD account to the module with an @ symbol in either the username or password and the application is using the ASCII character set then the character set that the module should be set to is UTF-8. If it is not then the module will interpret the symbol incorrectly.

Read command shows current setting and test command display conversion schemes implemented in the TA.

<chset>	*Description*
"GSM"	GSM default alphabet (GSM 03.38 subclause 6.2.1). **Default value**
"IRA"	International reference alphabet (ITU-T T.50). Note: recommended default value by GSM 07.07.
"8859-n"	ISO 8859 Latin *n* (1-6) character set
"UTF-8"	Universal text format, 8 bits
"ERICSSON"	Unicode, 16-bit universal multiple-octet coded character set (ISO/IEC10646)

Example!
```
AT+CSCS?
+CSCS: "GSM"

OK
```

16.16 *AT+CSMS Select Message Service*

Common for both PDU and Text Modes

Description	*Command*	*Possible Responses*
Select message service	AT+CSMS=<service>	• +CSMS: <mt>,<mo>,<bm> • +CMS ERROR: <err> • OK • ERROR
Show the current setting	AT+CSMS?	• +CSMS: <service>,<mt>,<mo>, <bm> • OK • ERROR
Show if the command is supported	AT+CSMS=?	• +CSMS: (list of supported <service>s) • OK • ERROR

Description:

Selects messaging service <service>. It returns the types of messages supported by the ME: <mt> for mobile terminated messages, <mo> for mobile originated messages and <bm> for broadcast type messages. If the chosen service is not supported by the ME (but is supported by the TA), final result code +CMS ERROR: <err> is returned.

<service>	*Description*
0	GSM 03.40 and 03.41. The syntax of SMS AT commands is compatible with GSM 07.05 Phase 2 version 4.7.0; Phase 2+ features which do not require new command syntax may be supported (e.g. correct routing of messages with new Phase 2+ data coding schemes)
2..127	Reserved

<mt>	*Description*
0	Mobile terminated messages not supported
1	Mobile terminated messages supported

<mo>	*Description*
0	Mobile originated messages not supported
1	Mobile originated messages supported

<bm>	*Description*
0	Broadcast messages not supported
1	Broadcast messages supported

<err>	*Description*
0...127	GSM 04.11 Annex E-2 values
128...255	GSM 03.40 subclause 9.2.3.22 values
300	ME failure
302	Operation not allowed
304	Invalid PDU mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
316	SIM PUK required
317	SIM PIN2 required
318	SIM PUK2 required
500	Unknown error
...511	Other values in range 256...511 are reserved
512...	Manufacturer specific

16.17 *AT*E2SMSRI Ring indicator for SMS*

Description	*Command*	*Possible Responses*
Enable RI for incoming SMS	AT*E2SMSRI=<n>	• OK • ERROR
Show the current setting	AT*E2SMSRI?	• *E2SMSRI: <n> • OK • ERROR
Show if the command is supported	AT*E2SMSRI=?	• *E2SMSRI: (list of supported <n>s) • OK • ERROR

Description:

This command enables/disables the Ring Indicator pin response to an incoming SMS message. If enabled, a negative going pulse is generated on receipt of an incoming SMS message. The duration of this pulse is selectable in steps of 50 ms up to a maximum of 1,150 ms and is determined by the value of <n> that is used in the command. The command is disabled by setting <n> to 0.

Note! The Ring Indicator will always be active for incoming calls independent of this setting.

<n>	*Description*
0	RI is disabled for incoming SMS messages. **Default value**
50-1150	RI is enabled for incoming SMS messages. Pulse duration selectable between 50 and 1,150 ms inclusive

17 Short Message Services - Cell Broadcast

17.1 *AT+CNMI New Message Indications to TE*

See 16.9, AT+CNMI New Message Indications to TE

17.2 *AT+CSCB Select Cell Broadcast Message Type*

Common for both PDU and text modes

Description	*Command*	*Possible Responses*
Select cell broadcast message type	AT+CSCB=[<mode> [,<mids>]]	• +CMS ERROR: <err> • OK • ERROR
Show the current setting	AT+CSCB?	• +CSCB: <mode>,<mids> • OK • ERROR
Show if the command is supported	AT+CSCB=?	• +CSCB: (list of supported <mode>s) • OK • ERROR

Description:

Selects which types of CBMs are to be received by the ME.

<mode>	*Description*
0	Message types in <mids> and <dcss> are accepted

<mids>	*Description*
string type	All different possible combinations of CBM message identifiers (refer <mid>) (default is empty string); e.g. “0,1,5-7” <mid> GSM 03.41 CBM Message Identifier in integer format

Example! AT+CSCB?
+CSCB: 0,“50”

OK

18 SIM Application Toolkit

18.1 *AT*E2STKS SIM Application Toolkit Settings*

Description	*Command*	*Possible responses*
Set the presentation of the unsolicited result codes corresponding to STK	AT*E2STKS=<on_off>	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT*E2STKS?	• *E2STKS: <on_off> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKS=?	• *E2STKD: list of supported <on_off> • +CME ERROR <err> • OK • ERROR

Description:

Allows the external application to disable or enable the presentation of the unsolicited result codes corresponding to the STK commands. Parameter <on_off> is used to disable or enable the presentation of an unsolicited result code *E2STK. Setting chosen is stored internally so that it is not necessary to change it each time the ME is switched on.

If the presentation of the unsolicited result codes is disabled, the messages below are not sent to the application.

The unsolicited result codes shall be disabled by default.

<on_off>	*Description*
0	Disable the presentation of the unsolicited result codes related to STK. **Default value**
1	Enable the presentation of the unsolicited result codes related to STK

Unsolicited Result Codes:

The unsolicited result codes defined in sections below can be received.

18.2 *AT*E2STKD M2M STK Display Text*

Description	*Command*	*Possible responses*
Answer to the reception of DISPLAY TEXT	AT*E2STKD=<answer>	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKD=?	• *E2STKD: (list of supported <answer>) • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within DISPLAY TEXT command to the external application by means of the unsolicited result code *E2STKD.

Command AT*E2STKD allows the external application to send the appropriate answer after receiving the unsolicited result code, and before the timeout expires.

If Answer command is sent once the timeout expires, an ERROR response is generated.

Test command returns the list of supported <answer>. Values follow GSM 11.14 standard

<answer>	*Description*
0	OK. Performed as required: the text was displayed and cleared as requested. It corresponds to ‘00’ Command performed successfully, described in the GSM standard
1	Failed. User Terminated Session: the text was displayed as requested and the user wants to end the proactive session. It corresponds to ‘10’ Proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backwards move: the text was displayed as requested and the user wants to go backwards in the session. It corresponds to ‘11’ Backward move in the proactive SIM session requested by the user
3	Failed. No response from user: the text was displayed, and although the clear condition was “Wait for user to clear”, the user did not react. It corresponds to ‘12’ no response from user
4	Failed. Screen is busy: the text could not be displayed

Unsolicited Result Codes:

*E2STKD: <priority>,<clear_condition>,<coding>,<text_length>, <text>

Values follow GSM 11.14 standard.

<priority>	*Description*
0	Display normal priority text
1	Display high priority text

<clear_condition>	*Description*
0	Clear message after a delay
1	Wait for user to clear message

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<text_length>	*Description*
Integer type	Value indicating the maximum length of field <text>

<text>	*Description*
string type	Field of maximum length <text_length>, in string type format between "". Coding is defined in <coding>

18.3 *AT*E2STKG M2M STK Get Inkey*

Description	*Command*	*Possible responses*
Answer to the reception of GET INKEY	AT*E2STKG =<answer>, [<response_type>, <user_response>]	• +CME ERROR <err> • OK
Show if the command is supported	AT*E2STKG=?	• *E2STKG: (list of supported <answer>), (list of supported <response_type>), <user_response> • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within GET INKEY command to the external application by means of the unsolicited result code E2STKG.

The external application then sends AT*E2STKG with the user response.

Answer command allows the external application to send the appropriate answer, after receiving the unsolicited result code, and before the timeout expires.

If Answer command is sent once the timeout expires, an ERROR response is generated.

If <answer> parameter is not 0, a failure has occurred and no more parameters are sent. If the extra parameters are sent, the ME indicates ERROR.

Test command returns the list of supported values, and the maximum value of <prompt_text_length>.

Values follow GSM 11.14 standard.

<answer>	*Description*
0	OK. Performed as required: the text was displayed. It corresponds to ‘00’ Command performed successfully, described in the GSM standard
1	Failed. User Terminated Session: the text was displayed as requested and the user wants to end the proactive session. It corresponds to ‘10’ Proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backward move: the text was displayed as requested and the user wants to go backwards in the session. It corresponds to ‘11’ Backward move in the proactive SIM session requested by the user
3	Failed. No response from user: the text was displayed, and the user did not react. It corresponds to ‘12’ No response from user
4	Failed. Screen is busy: the text could not be displayed

<response_type>	*Description*
0	Response type shall be digits (0-9, *, # and +)
1	Response type shall be SMS default alphabet
2	Response type shall be UCS2 Coded. We currently do not support this option, if you use it, an error will be returned.
3	Response type shall be “Yes/No” response

<user_response>	*Description*
String type	Field of 1 to 2 bytes length in string type format between “”. Coding is defined in <response_type>. Length shall be 2 bytes when coding is UCS2 . Otherwise it shall be 1 byte

Unsolicited Result Codes:

*E2STKG: <coding>,<prompt_text_length>,<prompt_text>

Values follow GSM 11.14 standard.

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<prompt_text_length>	*Description*
Integer type (0-235)	Value indicating the maximum length of field <prompt_text>

<prompt_text>	*Description*
String type	Field of maximum length <prompt_text_length>, in string type format between “”. Coding is defined in <prompt_coding>.

18.4 *AT*E2STKI M2M STK Get Input*

Description	*Command*	*Possible responses*
Answer to the reception of GET INPUT	AT*E2STKI=<answer>, [<response_type>, <response_length>, <user_response>]	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKI=?	• *E2STKI: (list of supported <answer>),(list of supported <response_type>), <response_length>, <user_response> • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within GET INPUT command to the external application by means of the unsolicited result code

E2STKI. The external application sends AT*E2STKI with the user response.
AT*E2STKI allows the external application to send the appropriate answer after receiving the unsolicited result code, and before the timeout expires.
If Answer command is sent once the timeout expires, an ERROR response is generated.
If <answer> parameter is not 0, a failure has occurred and no more parameters are sent. If the extra parameters are sent, the ME indicates ERROR.
Test command returns the list of supported values, and <prompt_text_length>.
Values follow GSM 11.14 standard.

<answer>	*Description*
0	OK. Performed as required: the text was displayed. It corresponds to '00' command performed successfully, described in the GSM standard
1	Failed. User terminated session: the text was displayed as requested and the user wants to end the proactive session. It corresponds to '10' proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backward move: the text was displayed as requested and the user wants to go backwards in the session. It corresponds to '11' backward move in the proactive SIM session requested by the user
3	Failed. No response from user: the text was displayed, and the user did not react. It corresponds to '12' No response from user
4	Failed. Screen is busy: the text could not be displayed

<response_type>	*Description*
0	Response type shall be digits (0-9, *, # and +)
1	Response type shall be SMS default alphabet
2	Response type shall be UCS2 Coded. We currently do not support this option. If you use it, an Error will be returned.
3	Response type shall be "Yes/No" response

<response_length>	*Description*
Integer type (0-160)	Value indicating the length of response field <user_response>. It shall be an integer within the range between <min_length_response> and

<max_length_response>

<user_response>	*Description*
String type	Field of length between <min_length_response> and <max_length_response>, in string type format between "". Coding is defined in <response_type>.

Note! If <response_type>=3 (Yes/No), the length of <user_response> is 1 byte. Otherwise, the ME gives an ERROR message.

Unsolicited Result Codes:

*E2STKI: <min_length_response>,<max_length_response>, <echo_input>,<prompt_coding>,<prompt_text_length>, <prompt_text>

Values follow GSM 11.14 standard.

<min_length_response>	*Description*
Integer type (0-160)	Value indicating the minimum length of response field <user_response>

<max_length_response>	*Description*
Integer type (0-160)	Value indicating the maximum length of response field <user_response>

<echo_input>	*Description*
0	The user input shall be echoed
1	The user input shall be hidden

<prompt_coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet
2	Text is coded in UCS2 alphabet, as defined in GSM 03.38. It corresponds to data coding scheme of 16 bit UCS2 alphabet

<prompt_text_length>	*Description*
Integer type	Value indicating the maximum length of field <prompt_text>

<prompt_text>	*Description*
String type	Field of maximum length <prompt_text_length>, in string type between “”. Coding is defined in <prompt_coding>

18.5 *AT*E2STKL M2M STK Select Item*

Description	*Command*	*Possible responses*
Answer to the reception of SELECT ITEM	AT*E2STKL=<answer>, [<user_response>]	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKL=?	• *E2STKL: (list of supported <answer>), (list of supported <user_response>) • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within SELECT ITEM command to the external application by means of the unsolicited result code *E2STKL.

Command AT*E2STKL allows the external application to send the appropriate answer after receiving the unsolicited result code, and before the timeout expires.

If Answer command is sent once the timeout expires, an ERROR response is be generated.

If <answer> parameter is not 0, a failure has occurred and no more parameters are sent. If the extra parameters are sent, the ME indicates ERROR.

Values follow GSM 11.14 standard.

<answer>	*Description*
0	OK. Performed as required. It corresponds to ‘00’ command performed successfully, described in the GSM standard
1	Failed. User terminated session. It corresponds to ‘10’ Proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backwards move. It corresponds to ‘11’ Backward move in the proactive SIM session requested by the user
3	Failed.

	No response from user. It corresponds to '12' no response from user
4	Failed. Screen is busy: the text could not be displayed

<user_response>	*Description*
integer type	The identifier is a single byte between 1 and 255. It identifies the selected <item_idn> within the items list

Unsolicited Result Codes:
E2STKL: <NbrOfItems>,<coding>,<text_length>,<alpha_id>
[,<default>]<CR><LF>E2STKL: <item_id1>,<coding>,
<text_length>,<item1><CR><LF>[…]E2STKL: <item_idn>,
<coding>,<text_length>,<itemn><CR><LF>]
Values follow GSM 11.14 standard.

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<text_length>	*Description*
Integer type (0-240)	Value indicating the maximum length of field <alpha_id>, <itemn1>,.<Itemn>

<alpha_id>	*Description*
String type	Field of string type between "". Coding is according to EF_{AND} as defined in GSM 11.11

The maximum length is fixed

<default>	*Description*
Integer type	The <default> parameter is a single byte between 1 and 255. It shows the default/selected item within the list

<item_idn>	*Description*
Integer type	The identifier is a single byte between 1 and 255. Each item <itemn> in the list shall have a unique identifier <item_idn>

<itemn>	*Description*

String type	Field of string type between “”. Coding is according to EF_{AND} as defined in GSM 11.11

<NbrOfItems>	*Description*
Integer type	Number of items to be presented in the following unsolicited results

The maximum length is fixed.

18.6 *AT*E2STKM M2M STK Set Up Menu*

Description	*Command*	*Possible responses*
Answer to the reception of SET UP MENU	AT*E2STKM=<answer> , <on_off>	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKM=?	• *E2STKM: (list of supported <answer>),(list of supported <on_off>) • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within SET UP MENU command to the external application, so that the STK menu can be built externally, by means of the unsolicited result code *E2STKM.

The current menu can be removed by sending only the parameter <on_off> = 0.

Answer command allows the external application to send the appropriate answer after receiving the unsolicited result code, and before the timeout expires.

If Answer command is sent once the timeout expires, an ERROR response is generated.

Values follow GSM 11.14 standard.

<answer>	*Description*
0	OK. Performed as required: it corresponds to ‘00’ command performed successfully, described in the GSM standard
1	Failed. User Terminated Session: the command was executed as requested and the user wants to end the proactive session. It corresponds to ‘10’ proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backwards move: the command was executed

	as requested and the user wants to go backwards in the session. It corresponds to ‘11’ backward move in the proactive SIM session requested by the user
3	Failed. No response from user: the command was executed, and the user did not react. It corresponds to ‘12’ no response from user
4	Failed. Screen is busy
5	Failed. Command beyond MEs capability. It corresponds to ‘30’. It was not possible to successfully integrate or remove the list of menu items

<on_off>	*Description*
0	Remove the current menu
1	New menu to be displayed

Unsolicited Result Codes:

*E2STKM: <NbrOfItems>,<coding>,<text_length>, <alpha_id><CR><LF>E2STKM: <item_id1>,<coding>, <text_length>,<item1>[<CR><LF>[…]E2STKM: <item_idn>, <coding>,<text_length>,<itemn>]

Values follow GSM 11.14 standard.

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<text_length>	*Description*
Integer type	Value indicating the maximum length of field <alpha_id>, <itemn1>, <Itemn>

<alpha_id>	*Description*
String type	Field of string type between "". Coding is according to EF_{AND} as defined in GSM 11.11

The maximum length is fixed.

<item_idn>	*Description*
Integer type	The identifier is a single byte between 1 and 255. Each item <itemn> in the list shall have a unique identifier <item_idn>

<itemn>	*Description*
String type	Field of string type format between “”. Coding is according to EF_{AND} as defined in GSM 11.11

<NbrOfItems>	*Description*
Integer type	Number of Items to be presented in the following unsolicited results

The maximum length is fixed.

The parameters have no default values.

18.7 *AT*E2STKN M2M STK Envelope (Menu Selection)*

Description	*Command*	*Possible responses*
Do the menu selection	AT*E2STKN=<sel_item>	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT*E2STKN=?	• *E2STKN: (list of supported <sel_item>) • +CME ERROR <err> • OK • ERROR

Description:

The application informs the ME about the selected menu item by means of the AT*E2SKTN command. The ME answers with OK, or ERROR.

The Do command allows the external application to select the menu item in the item list that was created by means of the SET-UP MENU command.

<sel_item>	*Description*
Integer type	The identifier is a single byte between 1 and 255. It identifies the selected menu item corresponding to SET-UP MENU command. Values follow the definition described in GSM 11.14

18.8 *AT*E2STKC M2M STK Set Up Call*

Description	*Command*	*Possible responses*
Answer to the reception of SET UP CALL	AT*E2STKC=<answer>	• +CME ERROR <err> • OK • ERROR

Show if the command is supported	AT*E2STKC=?	• *E2STKC: (list of supported <answer>) • +CME ERROR <err> • OK • ERROR

Description:

The ME passes the parameters within SET UP CALL command to the external application by means of the unsolicited result code *E2STKC, so that it takes up the decision on progressing or rejecting the call.

Answer command allows the external application to send the appropriate answer after receiving the unsolicited result code, and before the timeout expires.

If Answer command is sent once the timeout expires, an ERROR response is generated.

Values follow GSM 11.14 standard.

<answer>	*Description*
0	OK. Performed as required. It corresponds to ‘00’ command performed successfully, described in the GSM standard
1	Failed. User terminated session. It corresponds to ‘10’ Proactive session terminated by the user, described in the GSM standard
2	Failed. User requests backwards move. It corresponds to ‘11’ backward move in the proactive SIM session requested by the user
3	Failed. No response from user. It corresponds to ‘12’ no response from user
4	Failed. Screen is busy: the text could not be displayed
6	Failed. User rejected call set-up request. It corresponds to ‘22’
7	Failed. User cleared down call before connection or network release. It corresponds to ‘23’

Unsolicited Result Codes:

*E2STKC: <ton>,<dial_string>,<SetUpRequirement>,<coding>, <text_length>,<alpha_id>

Values follow GSM 11.14 standard.

<ton>	*Description*
Integer type	Field of 1 byte indicating the Type of Number, coded as for EF_{AND}. See GSM 04-08, section 10.5.4.7 for the allowed values

<dial_string>	*Description*
String type	ME number of format <ton>

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<text_length>	*Description*
Integer type (0-240)	Value indicating the maximum length of field <alpha_id>

<alpha_id>	*Description*
String type	Field of string type between “”. Coding is according to EF_{AND} as defined in GSM 11.11

The maximum length is fixed

18.9 *AT*E2STKE STK Send Short Message*

Unsolicited Result Code:

*E2STKE: <coding>, < text_length >, <alpha_id>

The ME passes the <alpha_id> within SEND SHORT MESSAGE command to the external application, by means of the unsolicited result code *E2STKE. This informs the external application that the ME is sending an SMS.

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7 bit GSM default alphabet

<text_length>	*Description*
Integer type (0-240)	Value indicating the maximum length of field <alpha_id>

<alpha_id>	*Description*
String type	Field of string type format between “”. Coding is according to EF_{AND} as defined in GSM 11.11
‘FF’	In case that the SIM does not provide the optional alpha identifier, or this is a null data object, the ME shall give ‘FF’ to indicate “Sending SMS”, so that the external application is informed

The maximum length is fixed.

18.10 *AT*E2STKP STK Send SS*

Unsolicited Result Code:

*E2STKP: <ton>, <SS_string>, <coding>, <text_length>, <alpha_id>, <SS_return>

The ME passes the parameters within SEND SS command to the external application, by means of the unsolicited result code *E2STKP. This informs the external application that the ME has sent an SS string to the network, and provides the current status after this operation.

<ton>	*Description*
integer type	Field of 1 byte indicating the Type of Number, coded as for EF_{AND}. See GSM 04-08, section 10.5.4.7 for the allowed values

<SS_string>	*Description*
String type	SS string of format <ton>

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7-bit GSM default alphabet

<text_length>	*Description*
Integer type (0-240)	Value indicating the maximum length of field <alpha_id>

<alpha_id>	*Description*
String type	Field of string type format between “”. Coding is according to EF_{AND} as defined in GSM 11.11
‘FF’	In case that the SIM does not provide the optional alpha identifier, or this is a null data object, the ME shall give ‘FF’ to indicate “SS string sent” so that the external application is informed

The maximum length is fixed.

<SS_return>	*Description*
Integer type	Field of 1 byte indicating the SS Return Result Operation code, as defined in GSM 04.80, so that the external application is informed about the result of the SS operation

18.11 *AT*E2STKU STK Send USSD*

Unsolicited Result Code:

*E2STKU: <coding>, <text_length>, <alpha_id>

Description:

The ME shall passes the <alpha_id> parameter within SEND USSD command to the external application, by means of the unsolicited result code *E2STKU. This informs the external application that the ME is sending a USSD string to the network.

<coding>	*Description*
0	Text is coded in unpacked format, using the SMS default 7-bit coded alphabet, as defined in GSM 03.38 with bit 8 set to 0. It corresponds to data coding scheme of 8 bit
1	Text is coded in packed format, using the SMS default 7-bit coded alphabet, packed in 8-bit octets, as defined in GSM 03.38. It corresponds to data coding scheme of 7-bit GSM default alphabet

<text_length>	*Description*
Integer type (0-240)	Value indicating the maximum length of field <alpha_id>

<alpha_id>	*Description*
String type	Field of string type format between “”. Coding is according to EF_{AND} as defined in GSM 11.11
‘FF’	In case that the SIM does not provide the optional alpha identifier, or this is a null data object, the ME shall give ‘FF’ to

	indicate “SS string sent” so that the external application is informed

The maximum length is fixed.

18.12 *AT*E2STKR STK Refresh*

Unsolicited Result Code:

*E2STKR: <indicator>

The ME informs the external application about the coming REFRESH command, by means of the unsolicited result code *E2STKR (e.g. Reset is coming).

<indicator>	*Description*
Integer type	Indicator describes the mode that the SIM has requested when sending a REFRESH command
0	SIM initialization and full file change notification
1	File change notification
2	SIM initialization and file change notification
3	SIM initialization
4	SIM reset

18.13 *AT*E2STKO SIM Application Toolkit Settings*

Parameter Command Syntax:

AT*E2STKTO = <Command>, <timer>

This command allows the external application to configure some general settings related to STK.

Defined values:

Parameter <Command> is used to define the command that the time parameter is going to be applied.

Parameter <timer> is used to fix the timeout period applicable to Proactive SIM mechanism.

<Command>	*Description*
Integer type (0-6)	It defines the command that the time parameter is going to be applied
0	All the commands with timeout associated are set to the value of <timer>

1	Get Inkey command timeout is set to the value of <timer>
2	Set Up Menu command timeout is set to the value of <timer>
3	Set Up Call command timeout is set to the value of <timer>
4	Display Text command timeout is set to the value of <timer>
5	Get Input command timeout is set to the value of <timer>
6	Select Item command timeout is set to the value of <timer>

<timer>	*Description*
Integer type (0-99)	Specifies the value in seconds to be set in the timeout associated with the command specified in <command>
0	All the commands timeouts are set to its default value
(1-99)	The timeout of the command specified in <command> is set to this value

Unsolicited result code:

*E2STKTO: <command>

19 Supplementary Services

19.1 *AT+CPIN PIN Control*

See 3.29, AT+CPIN PIN Control

19.2 *AT+CAOCAdvice of Charge*

Description	*Command*	*Possible Responses*
Execute command	AT+CAOC[=<mode>]	• [+CAOC: <ccm>] +CME ERROR: <err> • OK • ERROR
Show the current setting	AT+CAOC?	• +CAOC: <mode> • OK • ERROR
Show if the command is supported	AT+CAOC=?	• [+CAOC: (list of supported <mode>s] • OK • ERROR

Description:

Use of Advice of Charge supplementary service command enables the subscriber to get information about the cost of calls. With <mode>=0, the execute command returns the current call meter value from the ME. The command also includes the possibility to enable an unsolicited event reporting of the CCM information. The unsolicited result code +CCCM: <ccm> is sent when the CCM value changes, but no more than every 10 seconds. Deactivation of the unsolicited event reporting is made with the same command.

Read command indicates whether the unsolicited reporting is activated or not. Read command is available when the unsolicited result code is supported.

It is recommended (although optional) that the test command return the supported mode values.

<mode>	*Description*
0	Query CCM value

1	Deactivate the unsolicited reporting of CCM value
2	Activate the unsolicited reporting of CCM value

<ccm>	*Description*
String type	Three bytes of the current call meter value in hexadecimal format (e.g. “00001E” indicates decimal value 30); value is in home units and bytes are similarly coded as ACMmax value in the SIM

19.3 *AT*EDIF Ericsson Divert Function*

Description	*Command*	*Possible Responses*
Enable and disable notification with the unsolicited result code *EDIF	AT*EDIF=<onoff>	• +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*EDIF?	• *EDIF: <onoff> +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EDIF=?	• *EDIF: (list of supported <onoff>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command enables and disables notification of divert status changes with the unsolicited result code *EDIF.

<onoff>	*Description*
0	Disable notification with the unsolicited result code *EDIF
1	Enable notification with the unsolicited result code *EDIF

Unsolicited Result Codes:

*EDIF: <reason>,<status>,<classx>[,<number>,<type>]

19.4 *AT*EIPS Identity Presentation Set*

Description	*Command*	*Possible Responses*
Sets the alpha tag to be displayed in the ME	AT*EIPS=<ID>, <alphatag mode>	• +CME ERROR: <err> • OK • ERROR

Show the current setting	AT*EIPS?	• *EIPS: <ID1>,<alphatag mode1><CR><LF> *EIPS: <ID2>,<alphatag mode2><CR><LF> • +CME ERROR: <err> • OK • ERROR
Show if the command is supported	AT*EIPS=?	• *EIPS: (list of supported ID>s),(list of supported <alphatag mode>s) • +CME ERROR: <err> • OK • ERROR

Description:

This command enables or disables the presentation of the alpha tag of the Caller ID and Called ID to the TE if the ID is recognized. The alpha tag is the first name and the last name. The presentation is done by an unsolicited result code, *ELIP for Caller ID and *EOLP for Called ID.

<ID>	*Description*
1	Caller ID (*ELIP)
2	Called ID (*EOLP)

<alphatag mode>	*Description*
0	Off
1	First name and last name displayed

Unsolicited Result Codes:

*ELIP:<alpha tag>

*EOLP:<alpha tag>

19.5 *AT*ELIN Ericsson Line Set*

Description	*Command*	*Possible Responses*
Set the current line to <line>	AT*ELIN=<line>	• *ELIN: <line> • +CME ERROR: <err> • OK • ERROR
Show the current setting	AT*ELIN?	• *ELIN: <line> • +CME ERROR: <err> • OK • ERROR

Show if the command is supported	AT*ELIN=?	• *ELIN: list of supported <line>s +CME ERROR: <err> • OK • ERROR

Description:

This command requests the ME to set the current line to <line>.

Note! The following command reads its value from the current line and is thus affected by the use of *ELIN:

AT+CACM - Accumulated Call Meter

<line>	*Description*
1	L1
2	L2

19.6 *AT*E2SSD M2M Supplementary Service Dispatch*

Description	*Command*	*Possible Responses*
Send Supplementary Service command	AT*E2SSD=<SS_String>	• OK • ERROR
Show if the command is supported	AT*E2SSD=?	• OK • ERROR

Description:

This command allows the user to send a Public MMI command string in order to activate, deactivate, interrogate or modify settings for Supplementary Services.

Once a string is sent, the command will return OK if parsed and sent successfully, otherwise ERROR is returned. The command does not verify that the operation executes successfully - use the AT*E2SSI command to gain feedback of the operation status.

Refer to GSM 02.30 for Public MMI services and codes.

<SS_String>	*Description*
String Type	String in double quotes, containing a Public MMI command to modify, activate, interrogate or deactivate a Supplementary Service. String can contain values ‘0-9’, ‘*’ and ‘#’

19.7 *AT*E2SSI M2M Supplementary Service Indications*

Description	*Command*	*Possible Responses*
Set Supplementary Service indications	AT*E2SSI=<op>	• ERROR • OK
Show the current setting	AT*E2SSI?	*E2SSI: <op>
Show if the command is supported	AT*E2SSI=?	• *E2SSI: (list of supported <op>s) • ERROR

Description:

This command allows the user to display the unsolicited response code *E2SSI on network responses (either command confirmation or error responses) for Supplementary Services. This can be used in conjunction with the AT+CSSN command which gives responses on the network notification of SS status.

The default setting is OFF, where responses are disabled.

<op>	*Description*
0	Disable *E2SSI indications. **Default value**
1	Enable *E2SSI indications

Unsolicited Result codes:

*E2SSI:
<errorcode>[,<Opcode>[,<SS_Code>,[<BasicServChoice>,
<BasicServValue>],[<SS_Status>],[<ForwardedToNr>],
[<NoReplyConditionTime>], [<CLI_RestrictionOption>]]]

or

*E2SSI:
<errorcode>[,<Opcode>[,<SS_Code>,[<BasicServChoice>,
<BasicServValue>],[<SS_Status>],[<SubscriptionOption>]]]

<errorcode>	*Description*
0	OK (no error)
1	SSI_PASSWORD_ERROR
2	SSI_TOO_MANY_PARTS
3	SSI_COMMAND_ERROR
4	SSI_SIM_ERROR
5	SSI_NUMBER_ERR
6	SSI_CALL_BARRED
7	SSI_NOT_AVAILABLE

8	SSI_UNSUCCESSFUL
9	SSI_NOT_ALLOWED
10	SSI_NETWORK_PROBLEM

<Opcode>	*Description*
10	REGISTER_SS
11	ERASE_SS
12	ACTIVATE_SS
13	DEACTIVATE_SS
14	INTERROGATE_SS

<SScode>	*Description*
0	ALL_SS
16	ALL_LINE_IDENTIFICATION_SERVICES
17	CALLING_LINE_IDENTIFICATION_PRESENTATION
18	CALLING_LINE_IDENTIFICATION_RESTRICTION
19	CONNECTED_LINE_IDENTIFICATION_PRESENTATION
20	CONNECTED_LINE_IDENTIFICATION_RESTRICTION
21	MALICIOUS_CALL_IDENTIFICATION
32	ALL_FORWARDING_SERVICES
33	CALL_FORWARDING_UNCONDITIONAL
40	ALL_CONDITIONAL_FORWARDING_SERVICES
41	CALL_FORWARDING_ON_MOBILE_SUBSCRIBER_BUSY
42	CALL_FORWARDING_ON_NO_REPLY
43	CALL_FORWARDING_ON_SUBSCRIBER_NOT_REACHABLE
49	EXPLICIT_CALL_TRANSFER
64	ALL_CALL_COMPLETION_SERVICES
65	CALL_WAITING
66	CALL_HOLD
67	COMPLETION_OF_CALL_TO_BUSY_SUBSCRIBER
81	MULTI_PARTY
112	ALL_CHARGING_SS

113	ADVICE_OF_CHARGE_INFORMATION
114	ADVICE_OF_CHARGE_CHARGING
144	ALL_BARRING_SERVICES
145	BARRING_OF_OUTGOING_CALLS
146	BARRING_OF_ALL_OUTGOING_CALLS
147	BARRING_OF_ALL_OUTGOING_INTERNATIONAL_CALLS
148	BARRING_OF_ALL_OG_INTERNATIONAL_NON_HPLMN_DIRECTED_CALLS
153	BARRING_OF_INCOMING_CALLS
154	BARRING_OF_ALL_INCOMING_CALLS
155	BARRING_OF_ALL_IC_CALLS_WHEN_OUTSIDE_HPLMN

<BasicServChoice>	*Description*
2	BEARER_SERVICE
3	TELE_SERVICE

<BasicServValue>	*Description*	
	<TELE_SERVICE>	*<BEARER_SERVICE>*
0	TS_ALL_TELE_SERVICES	BS_ALL_BEARER_SERVICES
16	TS_SPEECH	BS_ALL_DATA_CDA_SERVICES
17	TS_TELEPHONY	BS_DATA_CDA_300BPS
18	TS_EMERGENCY_CALLS	BS_DATA_CDA_1200BPS
20		BS_DATA_CDA_2400BPS
21		BS_DATA_CDA_4800BPS
22		BS_DATA_CDA_9600BPS
24		BS_ALL_DATA_CDS_SERVICES
25		BS_DATA_CDS_300BPS
26		BS_DATA_CDS_1200BPS
28		BS_DATA_CDS_2400BPS
29		BS_DATA_CDS_4800BPS
30		BS_DATA_CDS_9600BPS
32	TS_ALL_SHORT_MESSAGE_SERVICES	BS_ALL_PAD_ACCESS_CA_SERVICES
33	TS_SHORT_MESSAGE_MT_PP	BS_PAD_ACCESS_CA_300BPS

34	TS_SHORT_MESSAGE_MO_PP	BS_PAD_ACCESS_CA_1200BPS
35		BS_PAD_ACCESS_CA_1200_75BPS
36		BS_PAD_ACCESS_CA_2400BPS
37		BS_PAD_ACCESS_CA_4800BPS
38		BS_PAD_ACCESS_CA_9600BPS
40		BS_ALL_DATA_PDS_SERVICES
44		BS_DATA_PDS_2400BPS
45		BS_DATA_PDS_4800BPS
46		BS_DATA_PDS_9600BPS
48		BS_ALL_ALTERNATE_SPEECH_DATA_CDA
56		BS_ALL_ALTERNATE_SPEECH_DATA_CDS
64	TS_VIDEOTEX	BS_ALL_SPEECH_FOLLOWED_BY_DATA_CDA
72		BS_ALL_SPEECH_FOLLOWED_BY_DATA_CDS
80	TS_TELETEX	BS_ALL_DATA_CIRCUIT_ASYNCHRONOUS
88		BS_ALL_DATA_CIRCUIT_SYNCHRONOUS
96	TS_ALL_FAX_SERVICES	BS_ALL_ASYNCHRONOUS_SERVICES
97	TS_FAX_GROUP3_ALTER_SPEECH	
98	TS_AUTOMATIC_FAX_GROUP3	
99	TS_FAX_GROUP4	
104		BS_ALL_SYNCHRONOUS_SERVICES
112	TS_ALL_DATA_SERVICES	
120		BS_12_KBIT_UNRESTRICTED_DIGITAL
128	TS_ALL_TELESERVICES_EXCEPT_SMS	
208	TS_AUXILIARY_SPEECH	
209	TS_AUXILIARY_TELEPHONY	

<SS_Status>	*Description*
0	NO_FLAG_SET
1	SS_STATUS_ACTIVE
2	SS_STATUS_REGISTERED
4	SS_STATUS_PROVISIONED

7	SS_STATUS_PRA

<ForwardedToNr>	*Description*
String	ME number string in double quotes

<NoReplyConditionTime>	*Description*
0-65532	Integer value for time

<CLI_Restriction Option>	*Description*
0	PERMANENT
1	TEMPORARY_DEFAULT_RESTRICTED
2	TEMPORARY_DEFAULT_ALLOWED

<Subscription Option>	*Description*
1	OVERRIDE_CATEGORY
2	CLI_RESTRICTION_OPTION
5	RESTRICTION_PER_CALL

Example!

```
AT*E2SSI=1  Orange
OK
AT*E2SSD="*#30#"
OK
*E2SSI: 0,14,17,,,4,,,
AT*E2SSD="*#31#"
OK
*E2SSI: 0,14,18,,,5,,,2
AT*E2SSI=1   Vodafone,T-Mobile, O2.
OK
AT*E2SSD="*#30#"
OK
*E2SSI: 0,14,17,,,5,,,
AT*E2SSD="*#31#"
OK
*E2SSI: 0,14,18,,,5,,,2
```

19.8 *AT+CCFC Call Forwarding number and Conditions*

Description	*Command*	*Possible Responses*
Request Calling forwarding number and conditions	AT+CCFC=<reason>, <mode>[,<number>[, <type>[,<class> [,<satype>]]]]	• +CME ERROR <err> • when <mode>=2 and command successful: +CCFC: <status>,<class1>[,<number>, <type>[,<satype>]][<CR><LF> +CCFC: <status>,<class2>[,<number>, <type>[,<satype>]][...]] • OK • ERROR
Show if the command is supported	AT+CCFC=?	• + CCFC: (list of supported <reason>s) • +CME ERROR <err> • OK • ERROR

Description:

This command allows control of the call forwarding supplementary service. Registration, erasure, activation, deactivation, and status query are supported. When querying the status of a network service (<mode>=2) the response line for ‘not active’ case (<status>=0) should be returned only if service is not active for any <class>.

<reason>	*Description*
0	Unconditional
1	Mobile busy
2	No reply
3	Not reachable
4	All call forwarding
5	All conditional call forwarding

<mode>	*Description*
0	Disable
1	Enable
2	Query status
3	Registration
4	Erasure

<number>	*Description*
string type	String type ME number of forwarding address in format specified by <type>

<type>	*Description*
integer format	Type of address octet
129	ISDN/telephony numbering plan, national/international unknown. **Default value if '+' is not in <sca>**
145	ISDN/telephony numbering plan, international number. **Default value if '+' is in <sca>**
161	ISDN/telephony numbering plan, national number
128 - 255	Other values

<satype>	*Description*
integer format	Type of subaddress octet
128	NSAP (X.213/ISO 8348 AD2), even number of address signals
136	NSAP (X.213/ISO 8348 AD2), odd number of address signals
160	User defined, even number of address signals
168	User defined, odd number of address signals
128 - 255	Other values reserved

<classx>	*Description*
integer	Sum of integers each representing a class of information. **Default value is 7**
1	Voice L1
2	Data
4	Fax
8	Short message service
16	Data circuit sync
32	Data circuit async
64	Dedicated packet access
128	Dedicated PAD access

<status>	*Description*

0	Not active
1	Active

19.9 *AT+CCWA Call Waiting*

Description	*Command*	*Possible Responses*
Request call waiting	AT+CCWA=[<n> [,<mode> [,<class>]]]	• when<mode>=2 and command successful: +CCWA:<status>,<class1>[<CR><LF> +CCWA: <status>,<class2>[…]] +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CCWA?	• +CCWA: <n> +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CCWA=?	• +CCWA: (list of supported <n>s) +CME ERROR <err> • OK • ERROR

Description:

This command allows control of the call waiting supplementary service according to 3GPP TS 22.083. Activation, deactivation and status query are supported. When querying the status of a network service (<mode>=2) the response line for 'not active' case (<status>=0) should be returned only if service is not active for any <class>. Parameter <n> is used to disable or enable the presentation of an unsolicited result code +CCWA: <number>,<type>,<class>,[<alpha>][,<CLI validity>] to the TE when call waiting service is enabled. The command is abortable when the network is interrogated.

The interaction of this command with other commands based on other GSM/UMTS supplementary services is described in the GSM/UMTS standards.

Test command returns values supported by the TA as a compound value.

<n>	*Description*
0	Disable
1	Enable

<mode>	*Description*
0	Disable
1	Enable
2	Query status

<classx>	*Description*
integer	Sum of integers each representing a class of information. **Default value is 7**
1	Voice L1
2	Data
4	Fax
8	Short message service
16	Data circuit sync
32	Data circuit async
64	Dedicated packet access
128	Dedicated PAD access

<status>	*Description*
0	Not active
1	Active

<number>	*Description*
String type	String type ME number of forwarding address in format specified by <type>

<type>	*Description*
Integer format	Type of address octet in integer format (GSM 04.08 10.5.4.7)

<err>	*Description*
0	ME failure
3	Operation not allowed
4	Operation not supported
21	Invalid index

30	No network service
31	Network timeout
100	Unknown

Unsolicited Result Codes:

+CCWA: <number>, <type>, <class>

Example! AT+CCWA=?
+CCWA: (0-1)

OK

AT+CCWA?
+CCWA: 0

OK

19.10 *AT+CHLD Call Hold and Multiparty*

Description	*Command*	*Possible Responses*
Request call related supplementary services	AT+CHLD=<n>	• +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CHLD=?	• +CHLD: (list of supported <n>s) • +CME ERROR <err> • OK • ERROR

Description:

This command allows control of the following call related services:

- a call can be temporarily disconnected from the ME but the connection is retained by the network;
- multiparty conversation (conference calls);
- the served subscriber who has two calls (one held and the other either active or alerting) can connect the other parties and release the served subscriber's own connection.
- This command should also be used when hanging up calls which have been initiated while a GPRS session is on going.

Calls can be put on hold, recovered, released, added to conversation, and transferred similarly as defined in 3GPP TS 22.030.

This is based on the GSM/UMTS supplementary services HOLD (Call Hold; refer 3GPP TS 22.083 clause 2), MPTY (MultiParty; refer 3GPP TS 22.084) and ECT (Explicit Call Transfer; refer 3GPP TS 22.091). The interaction of this command with other commands based on other GSM/UMTS supplementary services is described in the GSM/UMTS standards.

Note! Call Hold and MultiParty are only applicable to teleservice 11.

It is recommended (although optional) that test command returns a list of operations which are supported. The call number required by some operations is denoted by “x” (e.g. +CHLD: (0,0x,1,1x,2,2x,3)).

<n>	*Description*
...	Integer type; equals to numbers entered before SEND button in GSM 02.30 subclause 4.5.5.1
0	Releases all held calls or sets User Determined User Busy (UDUB) for a waiting call
0X	Releases a specific call X from a held multiparty call
1	Releases all active calls (if any exist) and accepts the other (held or waiting) call
1X	Releases a specific active call X
2	Places all active calls (if any exist) on hold and accepts the other (held or waiting) call
2X	Places all active calls on hold, except call X with which communication is supported
3	Adds a held call to the conversation
4	Connects the two calls and disconnects the subscriber from both calls (explicit call transfer)

“X” is the numbering (starting with 1) of the call given by the sequence of setting up or receiving the calls (active, held or waiting) as seen by the served subscriber. Calls hold their number until they are released. New calls take the lowest available number. Where both a held and a waiting call exists, the above procedures shall apply to the waiting call (i.e. not to the held call) in conflicting situation.

Note! The “directory number” case shall be handled with dial command D, and the END case with hangup command H (or +CHUP).

19.11 *AT+CLIP Calling Line Identification*

Description	*Command*	*Possible Responses*
Request calling line identification	AT+CLIP=<n>	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CLIP?	• + CLIP : <n>,<m> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CLIP=?	• + CLIP : (list of supported <n>s) • +CME ERROR <err> • OK • ERROR

Description:

This command refers to the GSM supplementary service CLIP (Calling Line Identification Presentation) that enables a called subscriber to get the calling line identity (CLI) of the calling party when receiving a mobile terminated call. Set command enables or disables the presentation of the CLI at the TE. It has no effect on the execution of the supplementary service CLIP in the network.

When the presentation of the CLI at the TE is enabled (and calling subscriber allows), +CLIP: <number>,<type> response is returned after every RING (or +CRING: <type>; refer to subclause “Cellular result codes +CRC” in GSM 07.07) result code sent from TA to TE. Whether this response is used when a normal voice call is answered, depends on the manufacturer.

Read command gives the status of <n> and also triggers an interrogation of the provision status of the CLIP service according to GSM 02.81 (given in <m>).

Test command returns values supported by the TA as a compound value.

<n>	*Description*
0	Disable
1	Enable

<m>	*Description*
0	CLIP not provisioned
1	CLIP provisioned

2	Unknown (e.g. no network)

Unsolicited Result codes:

+CLIP: <number>,<type>

<number>	*Description*
String type	String type ME number of format specified by <type>

<type>	*Description*
Integer format	Type of address octet in integer (refer to GSM 04.08 sub-clause 10.5.4.7)

Example! AT+CLIP=1
OK

RING

+CLIP: “07747008670”,129,,,“Matt L”,0

19.12 *AT+CLIR Calling Line Identification Restriction*

Description	*Command*	*Possible Responses*
Request calling line identification restriction	AT+CLIR=[<n>]	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CLIR?	• +CLIR: <n>,<m> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CLIR=?	• +CLIR: (list of supported <n>s) • +CME ERROR <err> • OK • ERROR

Description:

This command refers to CLIR-service according to GSM 02.81 that allows a calling subscriber to enable or disable the presentation of the CLI to the called party when originating a call.

Set command overrides the CLIR subscription (default is restricted or allowed) when temporary mode is provisioned as a default adjustment for all following outgoing calls. Using the opposite command can revoke this adjustment. If this command

is used by a subscriber without provision of CLIR in permanent mode the network will act according GSM 02.81.

The setting shall be per logical channel.

When the MS is turned off and then turned on again the parameter setting <n> shall turn back to default, i.e. the presentation of CLI shall be used according to the subscription of the CLIR service, <n> is 0.

Read command gives the default adjustment for all outgoing calls (given in <n>), and also triggers an interrogation of the provision status of the CLIR service (given in <m>).

Test command returns values supported by the TA as a compound value.

Note! On a per call base CLIR functionality is explained in subclause "ITU-T V.25ter dial command".

<n>	*Description*
0	Presentation indicator is used according to the subscription of the CLIR service
1	CLIR invocation
2	CLIR suppression

<m>	*Description*
0	CLIR not provisioned
1	CLIR provisioned in permanent mode
2	Unknown (e.g. no network)
3	CLIR temporary mode presentation restricted
4	CLIR temporary mode presentation allowed

19.13 *AT+CSSN Supplementary Service Notification*

Description	*Command*	*Possible Responses*
Presentation of notification result codes from TA to TE	AT+CSSN=[<n>[,<m>]]	• +CME ERROR <err> • OK • ERROR
Show the current setting	AT+CSSN?	• +CSSN: <n>,<m> • +CME ERROR <err> • OK • ERROR
Show if the command is supported	AT+CSSN=?	• +CSSN: (list of supported <n>s),(list of supported <m>s) • +CME ERROR <err>

- OK
- ERROR

Description:

This command refers to supplementary service related network initiated notifications. The set command enables or disables the presentation of notification result codes from TA to TE.

When <n>=1 and a supplementary service notification is received after a mobile originated call setup, unsolicited result code +CSSI: <code1>[,<index>] is sent to TE before any other MO call setup result codes presented in this ETS or in V.25ter. When several different <code1>s are received from the network, each of them shall have its own +CSSI result code.

When <m>=1 and a supplementary service notification is received during a mobile terminated call setup or during a call, or when a forward check supplementary service notification is received, unsolicited result code +CSSU: <code2>[,<index>] is sent to TE. In case of MT call setup, result code is sent after every +CLIP result code (refer command “Calling line identification presentation +CLIP”) and when several different <code2>s are received from the network, each of them shall have its own +CSSU result code.

Note! The difference between <index> and <cindex> is that <index> is a position mark while <cindex> is a unique value for each CUG. <index> is not supported.

Test command returns values supported by the TA as a compound value.

<n>	*Description*
0	Disable the +CSSI result code presentation status in the TA
1	Enable the +CSSI result code presentation status in the TA

<m>	*Description*
0	Disable the +CSSU result code presentation status in the TA
1	Enable the +CSSU result code presentation status in the TA

<code1>	*Description*
0	Unconditional call forwarding is active
1	Some of the conditional call forwarding are active
2	Call has been forwarded

3	Call is waiting
4	This is a CUG call (also <index> present)
5	Outgoing calls are barred
6	Incoming calls are barred
7	CLIR suppression rejected

<index>	*Description*
0…9	CUG index
10	No index (preferred CUG taken from subscriber data)

<code2>	*Description*
0	This is a forwarded call (MT call setup)
1	This is a CUG call (also <index> present) (MT call setup)
2	Call has been put on hold (during a voice call)
3	Call has been retrieved (during a voice call)
4	Multiparty call entered (during a voice call)
5	Call on hold has been released (this is not a SS notification) (during a voice call)
6	Forward check SS message received (can be received whenever)
10	Incoming call has been forwarded

19.14 *AT+CUSD Unstructured Supplementary Service Data*

Description	*Command*	*Possible Responses*
Request unstructured supplementary service data	AT+CUSD=[<n>[,<str>]]	• +CME ERROR: <err> • OK
Show the current setting	AT+CUSD?	• +CUSD: <n> • OK • ERROR
Show if the command is supported	AT+CUSD=?	• +CUSD: (list of supported <n>s) • OK • ERROR

Description:

This command allows control of the Unstructured Supplementary Service Data (USSD) according to GSM 02.90.

Both network and mobile initiated operations are supported. Parameter <n> is used to disable/enable the presentation of an unsolicited result code (USSD response from the network, or network initiated operation) +CUSD: <m>[,<str>,<dcs>] to the TE. In addition, value <n>=2 is used to cancel an ongoing USSD session. If <n> is not given then the default value 0 is taken.

When <str> is given, a mobile initiated USSD string or a response USSD string to a network initiated operation is sent to the network. The response USSD string from the network is returned in a subsequent unsolicited +CUSD: result code.

The interaction of this command with other commands based on other GSM supplementary services is described in the GSM standard.

Test command returns values supported by the TA as a compound value.

Some different scenarios are shown below:

- An incoming network initiated USSD-Notify should be presented to the external application as an unsolicited result code +CUSD: if the external application has enabled result code presentation.
- An incoming USSD-request asking for a reply should sent to the external application as an unsolicited result code +CUSD: if the external application has enabled result code.
- If the external application answers to the request with the command AT+CUSD then the ME sends the answer to the network.
- A USSD-request sent with the command AT+CUSD from the external application.

The different alternatives are shown below.

	Network	*Mobile Equipment*	*External application*
1	Signal	Sends unsolicited result code +CUSD	Result code presentation enabled, presented
2	Signal asking for reply	Sends unsolicited result code +CUSD	Result code presentation enabled, presented
3			Answer AT+CUSD
3b			Sends AT+CUSD

<n>	*Description*

0	Disable result code presentation in the TA
1	Enable result code presentation in the TA
2	Terminate (abort) USSD dialogue. This value is not applicable to the read command response

<str>	*Description*
string	String type USSD (when <str> parameter is not given, network is not interrogated): -If <dcs> indicates that GSM 03.38 default alphabet is used: *if TE character set other than “HEX” (refer command Select TE Character Set +CSCS): ME/TA converts GSM alphabet into current TE character set according to rules of GSM 07.05 Annex A

Example! 1

AT Command	*Result Code*	*Description*
AT+CUSD=1,“*34#”		Enable the Result Code presentation in the TAE and send a USSD-request
	+CUSD:1,“id code” OK	Further user action required, give id code
AT+CUSD=1,“7465338”		Id code given
	+CUSD:0 OK	No further user action required

Example! 2

AT Command	*Result Code*	*Description*
	+CUSD:0,“Expensive incoming call”	Incoming USSD-notify telling the user that the incoming call is expensive

Example! 3

AT Command	*Result Code*	*Description*
AT+CUSD=1,“*55*0700#”		Enable the Result Code presentation in the TAE and send a USSD-request asking for an alarm at the time 07:00
	+CUSD:0,“ALARM”	At 07:00 the network sends an alarm to the user

Example! 4

AT Command	*Result Code*	*Description*
AT+CUSD=1,“*#100#”		Enable the Result Code presentation in the TAE and send a USSD-request asking for the SIM’s phone number.
	+CUSD: 0,"07787154042"	Network replies with the phone number.

20 Embedded Application

20.1 *AT*E2APC Application Program Control*

Description	*Command*	*Possible Responses*
Set application Program Control	AT*E2APC=<cmd>[,<stopType>][,<StartType>][,<Ctrl Byte>]	• ERROR • OK
Displays current settings	AT*E2APC?	• E2APC: <active>,<RunOnStartUp>,<halted>,<Ctrl Byte> • OK
Shows if the command is supported	AT*E2APC=?	• *E2APC: (list of supported <cmd>s, list of supported <StartType>s, list of supported <CtrlByte>s) • ERROR

Description:

This command allows the user to start and stop the application running in the module. The command allows a number of ways to start the application code, and some ways to stop/pause the running application.

Start Application (<cmd> = 1)

This parameter sets the application to start. The application can be started straight away, in which the currently active script (set with AT*E2APD command) is loaded and run, or it can be set to run on the next powercycle, from startup. The second option is stored persistently, so the application will start on power up every time it is switched on. The script marked as active will be the one that is started.

Error Recovery - If a new script is downloaded, the old script id is stored as a “Last Known Good Script” (until it is overwritten or deleted). If the module is reset and on startup the application runs and then hits a runtime error, the module will delete the offending script and reinstitute the last good script. The module will then restart, and run the old script. This behaviour only occurs if the script is set to run on startup.

The final option allowed lets the application restart from a “Pause” state - see the Stop command.

Stop Application (<cmd> = 0)

This parameter sets the application to stop. This will only work if the application is currently running. There are three options - the application can be requested to stop and restart, can be forced to halt (“pause”), or stopped on the next powercycle of the module.

The stop and restart function sends a signal to the application, which it will read when it handles system signals. The handler to this function will clear down the current interpreter instance and respond to the signal that the application has restarted. If there is no response to this signal within 1 second, then the command will respond that it is unsucessful. This command will not affect the running of the application on subsequent powercycles.

The halt function does not request anything of the application - it just stops the application process and renders it inactive (by force). This is “pause” mode, as the application cannot be reset until the module is power cycled. The application can be “restarted” from the pause state, which will re-enable the process and allow it to run from the point it was stopped - this may cause information to be lost. This command will not affect the running of the application on subsequent powercycles.

The stop on next powercycle does not affect the current running of the application, but will mean that it is not run at start up on the next module powercycle.

Write to CtrlByte (<cmd> = 2)

This parameter sets a byte variable which is available in the system status register available to the script when it is running. Just writing a valid value to this byte will set the APPS_AT_CTRL_TRIGGER flag in the application, and the value written is stored in the APPS_AT_CTRL_BYTE variable. These flags and variables can be read using intrinsic functions in the script, and allows the script to be dynamically controlled by the AT command port. This can be used to add breakpoints when debugging scripts, and also allow runtime modification of the scripts operation.

Abortability:

This command may not be aborted.

Defined values:

Table 1. <cmd>: parameter

<cmd>	Description
0	Stop application
1	Start application
2	Write to CtrlByte (available to read by a running script)

Table 2. <StartType>: parameter

<StartType>	*Description*
0	Start Now (one shot) - Default
1	Start on next powercycle (persistent)
2	Restart (from pause state)

Table 3. <StopType>: parameter

<StopType>	*Description*
0	Stop and Reinitialise (one shot) -Default
1	Stop on next powercycle (persistent)
2	Halt / Pause

Table 4. <CtrlByte>: parameter

<Active>	*Description*
0 - 255	CtrlByte value from 0 - 255

Table 5. <Active>: parameter

<Halted>	*Description*
0	Application is inactive
1	Application is active

Table 5. <Halted>: parameter

<Halted>	*Description*
0	Application is not Halted
1	Application is Halted

Table 6. <RunOnStartUp>: parameter

<RunOnStartUp >	*Description*

0	Application is not run on module start up
1	Application is run on module start up

20.2 AT*E2APD Application Program Download

Description	*Command*	*Possible Responses*
Set Application Program Download	AT*E2APD=<cmd>,<ScriptNum>[,<length>]	ERROR OK *E2APD: <error>ERROR
Displays current settings	AT*E2APD?	*E2APD: <ScriptNum>,<AvlSpace> OK
Shows if the command is supported	AT*E2APD=?	*E2APD: (list of supported <cmd>s,list of supported <ScriptNum>s) ERROR

Description:

This command allows the user to download scripts to the module for execution as an embedded application. It also allows the management of the active script, and the deletion of scripts. If there is no script active, then all the NVM space is available for scripts. Only an active script will be considered as non-overwriteable.

Four operations are currently allowed:

Download (<cmd> = 0)

With this command, the number of the script to be downloaded, and the length in number of “lines” (128 byte chunks), is supplied as initial parameters. After the <CR> the switch is made into script download mode (Xmodem-CRC protocol). The data is then transferred across the serial interface using the Xmodem-CRC protocol. Transfer is terminated by sending 2*EOT bytes. The first chunk of data sent contains the script information, the subsequent chunks are script data.

Example! AT*E2APD=0,1,100<CR>
C (Script downloaded here) …… (EOT*2)
OK

OK is only returned if the downloaded script is verified without errors, otherwise an error code is reported. The script is verified by checking the number of chunks received is as given by the

command, and that the script information given in the first chunk matches with the script information generated by the interpreter internal to the module. The script that may previously have been in this slot will be rendered invalid, even if the download fails.

Upload Script (<cmd> = 1) (NOT YET SUPPORTED)

With this command it is possible to retrieve the specified script from the Module NVM. The file is output in hex bytes, terminated by <CR><LF>OK.

Example!
```
AT*E2APD=1,1<CR>
*E2APD: 1
< Script Data >
OK
```

This example requests script 1 to be uploaded.

Delete Script (<cmd> = 2)

With this command, the script which is defined is deleted from NVM. If it is the inactive script it is deleted, without affecting the active script. This can be done while the application is running. If the script is the running script and the application is running or paused, then the command will return an error. The application will need to be stopped before erasing the running script (using AT*E2APC).

Make Script Active (<cmd>= 3)

With this command, the script defined is made active. If there is another script that is currently active and running, the command will fail. If it is not running then the active script will be made inactive and the new script will be made active. If the script number provided is outside the valid script number range, then no scripts are made active (effective deactivation).

When one script is running, it is possible to make the other script active. This means that the next time the application is started the other script will be run. This allows the possibility of hot swapping scripts. If one script is running and the other is made active, then the read function returns that there is no space for more scripts - as neither an active or a running script can be overwritten until deactiveted, deleted or stops running.

Abortability:

This command may not be aborted.

Defined values:

Table 7. <cmd>: parameter

<cmd>	*Description*
0	Download Script (to module)
1	Upload Script (from module)
2	Delete Script
3	Make Script Active

Table 8. <ScriptNum>: parameter

<ScriptNum>	*Description*
0-1 (255)	Integer giving script number cmd is to operate on. With activate command, script numbers > 0-1 will make no scripts active (255 indicates no script active).

Table 9. <length>: parameter

<length>	*Description*
0-350	Length of Script in 128byte chunks

Table 10. <error>: parameter

<error>	*Description*
0	Download OK
1	Syntax error in code
2	Not enough space for script
3	Transfer cancelled
4	Transfer timeout
5	Miscellaneous (structural) error

Table 11. <Script Data>: parameter

<ScriptData>	*Description*
Hex Data	Data sent in Xmodem-CRC packets. (128bytes payload per packet)

Table 12. < AvlSpace >: parameter

<AvlSpace>	*Description*
Decimal value 0-350	Decimal value representing available swap space for a non-active script. (Max Space - ActiveScript Size)

20.2.1 Xmodem-CRC Protocol (CCITT)

Note! The information here is not enough to write your own loader for the embedded applications, if you want to write your own contact customer support.

The Download of scripts with the AT*E2APD command uses the Xmodem-CRC protocol. This section explains how this is implemented with respect to the module:

Background

The following terms are simply ASCII codes:

SOH = chr(1) = CTRL-A = Start of header

EOT = chr(4) = CTRL-D = End of Transmission

ACK = chr(6) = CTRL-F = Positive Acknowledgement

NAK = chr(21) = CTRL-U = Negative Acknowledgement

CAN = chr(24) = CTRL-X = Cancel

In order to send the file, you must first divide it into 128 byte sections (packets). Bytes 0-127 of the file make up the first packet, bytes 128-255 make up the second packet, etc.

The packet number sent is simply the number of the packet (packet number starts at 0 at beginning of transmission). If the packet number is greater than 255, then subtract 256 repeatedly until the number is between 0 and 255. For example, if you were sending packet 731, then you would send 731 - 256 - 256 = 219.

The 1's complement of a byte (to make life easy) is simply 255 minus the byte. For example, if you had to take the 1's complement of 142, the answer would be 255 - 142 = 113.

CRC stands for Cyclical Redundancy Check. In X-Modem CRC, it is also referred to as CRC-16 since there are 16 bits (1 word) at the end of the block that contain the CRC. This 1 word (2 byte) CRC replaces the 1 byte checksum in X-Modem. In this implementation the CCITT polynomial is used to generate the CRC - X16 + X12 + X5 + 1.

CRC-16 guarantees detection of all single and double bit errors, all errors with an odd number of bits and over 99.9969% of all burst errors.

The easiest and fastest way to calculate the CRC is to use a lookup table.

The first byte the downloader sends is referred to as the NCGbyte, in this case is capital C in ASCII.

The Actual Transfer

The uploader waits until the downloader sends a NCG byte. The NCG byte is the signal that the downloader is ready to start. If the downloader takes too long or an error occurs then the uploader will stop waiting or “Time Out” (after 20 seconds). If this happens, then the file transfer must restart (a CAN byte is sent by the module and an error code is output)

With each packet sent the uploader sends:

1 SOH byte {1 byte}

2 The packet number {1 byte}

3 The 1's complement of the packet number {1 byte}

4 The packet {128 bytes}

5 The high byte of the CRC-16 {1 byte}

6 The low byte of the CRC-16 {1 byte}

The above six things are called the block.

The downloader:

1 Ensures that the packet number sent matches the actual packet number that it is (If the third block sent has a '4' as the second byte, something is wrong --> CANCEL TRANSFER (send CAN byte)).

2 Adds the packet number and the 1's complement of it together to make sure that they add up to 255. If they don't --> CANCEL TRANSFER.

3 Sets the CRC to 0xFFFFFFFF and then calculates the CRC for the 128 bytes of data.

4 Compares the received CRC-16 with the calculated one.

5 If everything looks ok, then the downloader appends the bytes in the packet to the file being created (sent). The downloader then sends an ACK byte which tells the uploader to send the next block. If the sums do not match then the downloader sends an NAK byte which tells the uploader to send the same block it is just sent over again.

When the uploader sends an EOT byte instead of an SOH byte, the downloader sends a NAK byte. If the uploader sends another EOT immediately after that, the downloader sends an ACK byte and the transfer is complete.

The downloader can cancel the transfer at any time by sending a CAN byte. The uploader can only cancel between blocks by sending a CAN byte. It is recommended that you send anywhere between 2 and 8 consecutive CAN bytes when you

wish to cancel as some programs will not let you abort if only 1 CAN byte is sent.

21 Environmental

21.1 *AT*E2OTR Operational Temperature Reporting*

Description	*Command*	*Possible Responses*
Enable/disable Temperature Reporting	AT*E2OTR=<n>	• +CME ERROR <err> • ERROR • OK
Read current setting	AT*E2OTR?	• E2OTR: <n>,<stat>,<temp> • OK • ERROR
Test if the command is supported	AT*E2OTR=?	• E2OTR: (list of supported <n>s) • OK • ERROR
Unsolicited response		• E2OTR: <stat>

Description:

The AT*E2OTR command enables or disables Operational Temperature unsolicited reports. When reporting is enabled, the unsolicited response *E2OTR is sent every time the module gets in and out of operational temperature range. The unsolicited response reports the current operational temperature status (in or out of range) as defined in the table below.

If the reporting is enabled, a report will always be sent at start-up, even if there has not been a change.

A transition from -40C to -41C or from +85C to +86C will cause an unsolicited report with an out of range indication, if the module was in range.

A transition from -40C to -39C or from +85 to +84C will cause an unsolicited report with an in range indication, if the module was out of range.

The report setting is persistent and will remain after a power cycle.

Table 1. <n> : parameter

<n>	*Description*
0	Disable Operational Temperature Reporting
1	Enable Operational Temperature Reporting

Table 2. <stat> : parameter

<stat>	*Description*
0	Out of range
1	In range

Table 3. <temp> : parameter

<temp>	*Description*
(~ -50 to 100)	Integer Temperature in degree Celcius

22 Alphabetical Listing of AT Commands

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Appendix A Module software and manual versions

Below is a table relating software versions across to manual versions.

Module software version	*Manual version*
R4A018	R1A
R5B003	R1B
R5B009	R1D, R1E
R6A023	R1F

Note! The above table relates to type approved versions only, if using non type approved software guidance should be sought from customer support.